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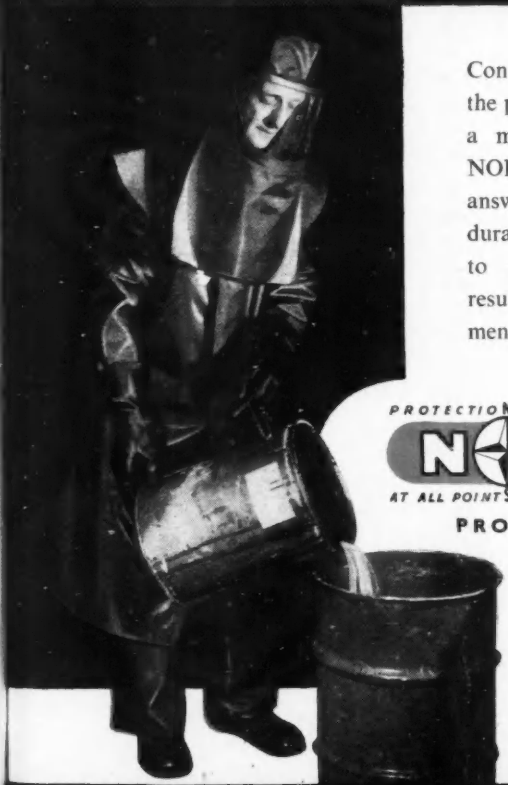

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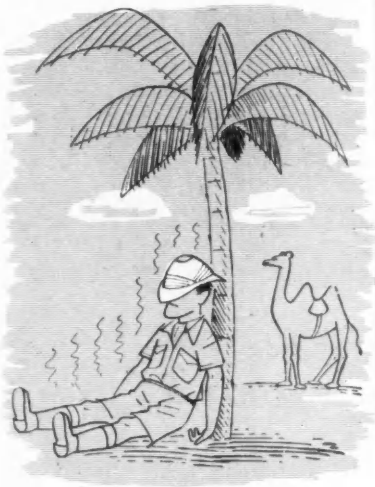

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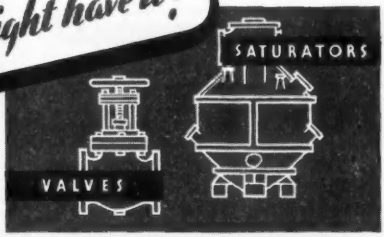

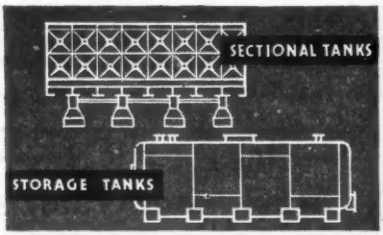

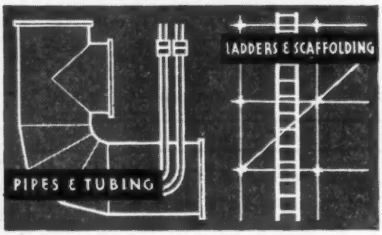

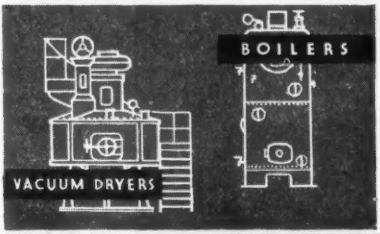

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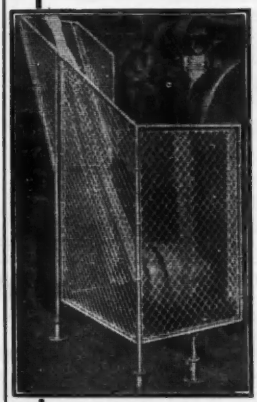

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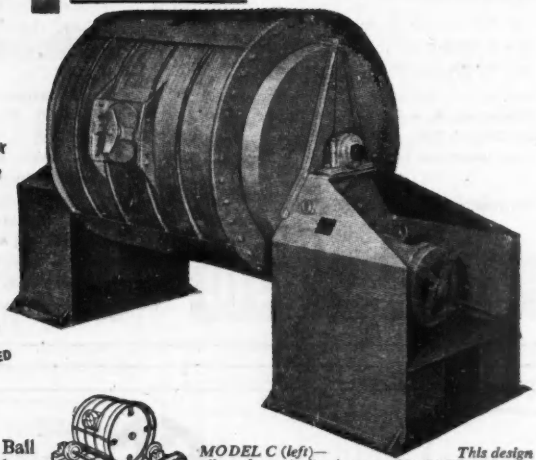

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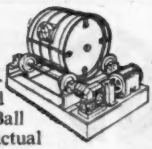

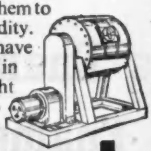

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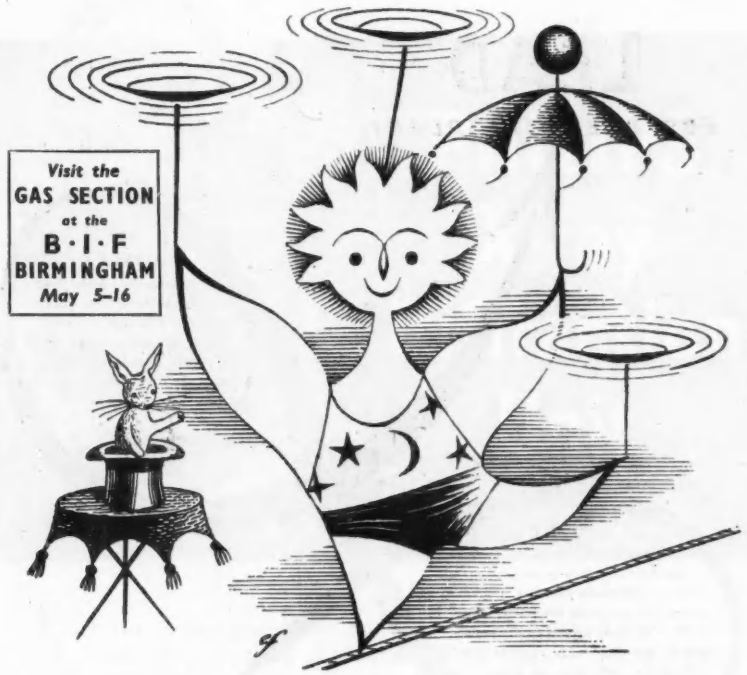

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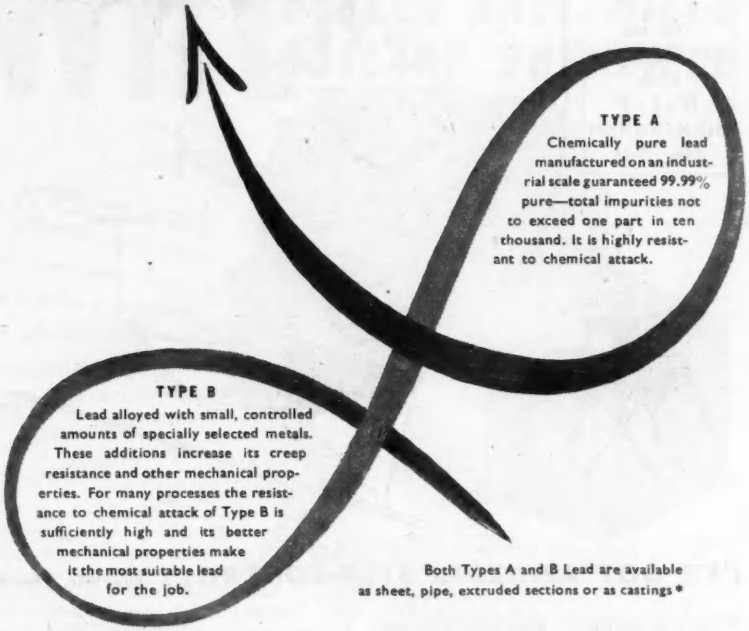

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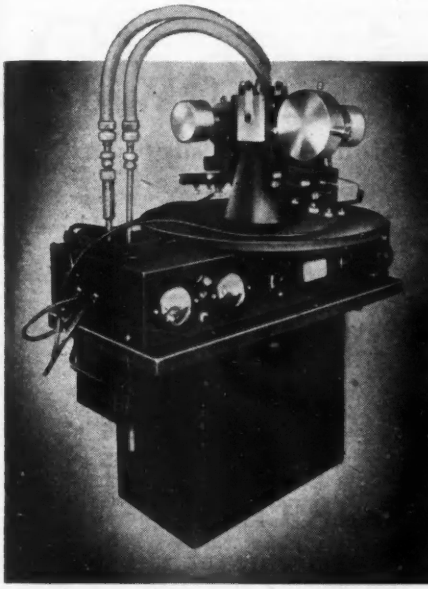

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Volume LXVI 19 April 1952 Number 1710

A Chemist on Food

IF again these columns must concern themselves with food, the blame must be laid this time upon a former scientific officer of the Ministry of Food and chemist, Dr. Magnus Pyke. For his exceedingly good book on food technology ('Townsman's Food,' 1952, Turnstile Press, London, pp. 212, 15s.) has just been published and there are two inescapable reasons for making it a principal topic of comment. First, no other book exists for providing the intelligent citizen with a general account of the nature and purpose of twentieth century food processing. Second, we have so often urged that scientists should take the lead in seeking public comprehension and co-operation that it would be grossly unjust not to applaud so excellent an example as Dr. Pyke's book. Though it covers a wide field, and one that is sometimes complex and often controversial, the author has maintained from start to finish a direct simplicity of style and has most commendably eschewed those out-of-date gambits of the ineffective popularisers, the 'Miracles-of-Science' technicolours and the self-conscious condescension of the ivory tower dwellers. He has assumed that a reader with average commonsense will want only a limited amount of detail about actual food processes but will want to know—and quite critically—WHY such processes are employed.

Most chemists, if prepared to make the effort, can give an account of their work in terms that the ordinarily intelligent reader can absorb; but mere clarity is not enough. The objective training of a scientist may make him a good scientist—but the mental outlook of so many of his fellow-men remains subjective. Really effective books about science for the public require considerable experience of the no-man's-land between laboratories and life. Dr. Pyke's years at the Ministry of Food may well have been the most important contributory influence to his new success as a modern scientific writer. He knows the width of the gap between scientific knowledge and public acceptance; and he knows, too, that reasoning cannot start until the almost instantaneous prejudices and inhibitions against 'something different' have been patiently dispersed. One sentence from his preface is enough: 'We are naturally conservative about food and when one is conservative one is also suspicious.'

The title, perhaps slightly misleading, does not intend a suggestion that food for the city is a greatly different thing from food for the countryman. It is a metaphorical crystallisation of the

author's opening sentence and, indeed, of the theme of his entire book: 'In order to feed the crowded numbers of a modern civilised community there must be a complex food industry, and the articles of food which it handles must be of such a quality that they will resist this necessary handling.' There, too, is the answer for the so-called naturalists, the persistently anti-scientific critics who contend that all was so much better in the days of simple food habits and could be again; the whole of the United Kingdom is now a crowded community and though an isolated farm or smallholding might feed its own family the diet would be dull and possibly inadequate at times without the additional contributions of food preservation and food processing. Dr. Pyke has tried to explain first and foremost that most of our modern food processing is essential if enough food is to be stored and distributed in a modern community, and only secondarily to describe the various processes that are mainly used.

Chapter by chapter the major articles of diet are discussed—bread, meat, fish, poultry, eggs, dairy produce including ice cream, fats, sugar and sweetening agents, vegetables, fruit and jam. In the face of so much perfection in blending information with sound argument, it seems churlish to criticise, but fruit might well have been given greater space if only to emphasise the comparative neglect (which is implied if not stated by Dr. Pyke) with which this country has regarded fruit product development. Certainly fruit deserved separation from jam, that sticky marriage of convenience with sucrose that seems to be all that Britain asks of her most fragrant crops. Finally, there is a chapter on food and the law in which the author is more concerned with the new positive standard-setting legislation than with the negative watch-dog edicts of the past.

On the subject of chemical additives, Dr. Pyke is forthright in condemning the few whose use has been found precarious, e.g., 'Agene,' dulcin, liquid paraffin. He insists, as we have frequently insisted in these columns, that each additive should be judged on its own merits or de-merits. 'It is right for people to suspect danger from the addition of chemicals to food.' Suspicion, however, should not become general accusation—instead it must be the mainspring of exhaustive examination.

The last words must be provided by the author himself. 'It is foolish for a person who likes a good table to oppose modern innovations in food technology as a whole. Individual developments have been found to be bad and more doubtless will occur in the future . . . . In general, there is no doubt that food technology, as we know it today, has been to the benefit of the modern citizen.' This Dr. Pyke has abundantly proved to all save the most intractably prejudiced, and at the same time he has provided a wealth of information about modern food chemistry.

On Other Pages

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Notes & Comments

Smith, Robinson & Brown

THAT indefatigable reformer of our nomenclature, Dr. G. M. Dyson, has followed his scheme for a new notation for organic chemicals by presenting us with a quite different problem of names—the age-old problem of the Smiths, the Jones-es, the Robinsons, etc. (*Chemistry & Industry*, 1952, **10**, 210). There are 838 Smiths at present making contributions to chemical journals, and research by the Bureau of Abstracts has revealed that 56 pairs, 51 trios, 37 quarters . . . and finally one group of 11 have identical initials. There are 201 Robinsons with 27 pairs with identical initials. As to the Jones and Browns of the scientific world, Dr. Dyson's brief notes give us no information but we can assume that the task of the indexers and librarians is no less formidable. Dr. Dyson raises the following points. Should not all editors of abstracts print first Christian names in full? Should not lists of dual or multiple 'names' be issued so that editors of journals could take steps to avoid confusion? Also, should not writers who quote names of other workers in their own papers give initials as well as surnames? All these suggestions are obviously constructive. If none of them would solve the basic problem that is involved, each would certainly reduce the present tendencies for time-wasting confusion.

Modesty to Blame?

IT is not irrelevant to reflect upon the modesty of scientific workers that is revealed by this problem. Actors and writers would never risk a thousandth part of the self-obliteration that our chemical Smiths and Robinsons seem to enjoy and even encourage. Perhaps we should consider a *nom-de-lab* like the popular author's *nom-de-plume* for the future young scientist whose birth-name comes from one of the massive name-families? Even in social and business life, many a Smith or Brown becomes impatient with his much-shared lot and he brings in his wife's maiden surname or, less originally, changes Smith to Smythe or Brown to Browne. Alternatively, the Government might consider raising all the name-multiples of science to the peerage; yet a man who was so well-known and unmistakably well-known in most of his life as F. E. Smith actually became rather less widely known as Lord Birkenhead.

Detergents as Animal Food?

THE ability of antibiotic substances to increase the growth-rates of some animals is now well established. A particularly surprising development, also from the United States, is that some detergents will produce similar effects. This might be regarded as a story to test human gullibility if the evidence did not come from two or three separate investigations. In Ohio the National Distillers Products Corporation of Cincinatti has reported that certain surface-active agents, among them preparations made for laundry use, have been shown to 'promote an increase in growth ranging to 12 per cent above controls.' The report is said to be based on two years' laboratory and field tests. At Michigan State College, a surface-active substance, described as an ethomid, enabled pigs to gain 1.3 lb. per day, while pigs not receiving the supplement gained 1.1 lb. per day. Both research teams suggest that the benefits are derived either from the surface-active chemical's ability to kill harmful bacteria or through their wetting powers enabling the feed to be more effectively assimilated. One test has so far been made by the U.S. Department of Agriculture and this has not confirmed the Ohio or Michigan results; however, only a few young chicks were used and further tests are arranged for 1952.

U.K. Tests Desirable

THERE are two important aspects of this discovery if it is eventually confirmed and found to be generally reproducible. The similar use of antibiotics has been validly criticised on the grounds that resistant bacteria may develop and present new disease hazards. There seems

much less cause for a similar fear in the case of detergent substances. Secondly, the use of antibiotic supplements for animal feeding in this country is not at present officially recommended or authorised. The supply of the necessary material would depend upon imports and until further and large-scale tests have shown such a course to be warranted imports will not be arranged. It would seem desirable for the Agricultural Research Council also to test detergents as feeding supplements for these substances would not have to be imported.

IN THE EDITOR'S POST

The Housewives' League

SIR,—My attention has been drawn to your remarks in your issue of 29 March on the intentions of the British Housewives' League in regard to chemicals.

It is obvious that you failed to read my letter printed in *The Sunday Times* to the end or you could hardly have failed to see that we take our stand on the right of man to choose whether or not he wants to take the dose prescribed; in other words, we demand freedom of choice and object strongly to enforced mass dosing.

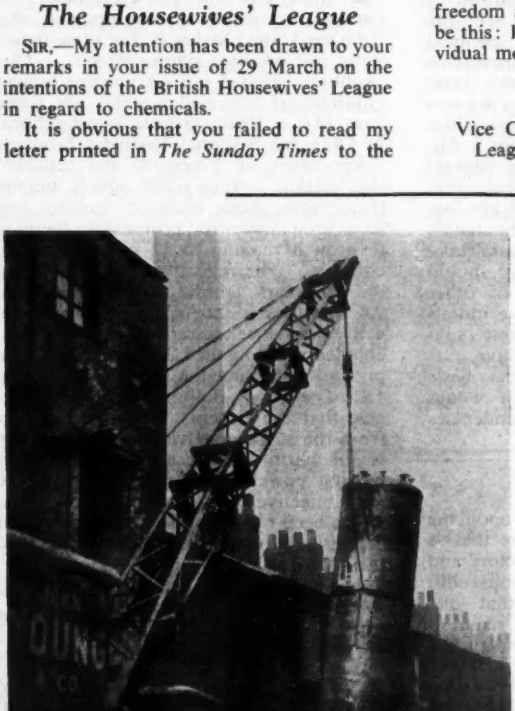
We urge the appointment of a Select Committee to inquire into the nature, extent and effects of the use of chemicals, compounds and synthetics in the production, processing and preparation of foodstuffs. It is time that the Foods and Drugs Act were amended so that it will no longer be possible for toxic chemicals to be added to foodstuffs.

We are aware that scientific opinions differ as to the desirability of adding calcium to flour, iodides to common salt, fluorides to water; surely the moral for lovers of both freedom and common sense would seem to be this: Let doctors and dentists decide individual medical needs on an individual basis.

Yours faithfully,

WINIFRED M. SYKES.

Vice Chairman, British Housewives' League.



The problem of installing a new autoclave in the factory of Messrs. Victor Wolf, Ltd., of Clayton, Manchester, was satisfactorily solved by cutting a hole in the building and employing a mobile crane to lift the vessel into position. Of welded stainless steel construction, the autoclave, which was made by Messrs. G. S. Harvey of London, will be used for the batch hydrolysis of fats and oils for the production of fatty acids and glycerine

The 1952 OCCA Exhibition

Raw Materials & Equipment on Show

AT an exhibition held at the Borough Polytechnic, London, on 7, 8 and 9 April, a selection of raw materials and equipment used in the paint, varnish and printing ink industries was displayed. The exhibition was organised by the London section of the Oil & Colour Chemists' Association and was better supported than ever.

The products on show covered a wide field and many interesting new substances and instruments were shown. The standard of the individual stands was not, however, as good as last year, when perhaps the Festival may have had its influence. Chemicals are extremely difficult subjects to make attractive to the eye, but many firms resorted to the age-old method of simply sticking their particular product in a test-tube, flask or beaker and giving it a coloured disc for a background with or without printed explanations beside it. Few made good use of colour in the design of their stands.

Firms Exhibiting

The exhibition was in three halls of the polytechnic. In the Edric Hall there were 14 firms exhibiting, among them Monsanto Chemicals, British Geon, and British Industrial Solvents.

Tintometer, Ltd., showed an appropriately colourful stand explaining the measurement of colour with reference to the C.I.E. International Colour System, by use of their Lovibond-Schofield Tintometer, a simple visual instrument for measuring colour in terms of Lovibond Red, Yellow and Blue units. Their Lovibond Comparator was also demonstrated.

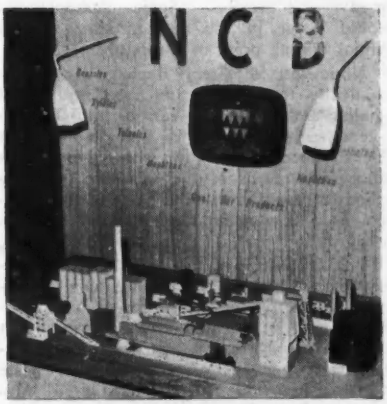
Plastanol, Ltd., showed stages in the manufacture of their two main products—'Plastoprene', an isomerised rubber resin, and the 'Plastokyd' range of alkyd resins. Considerable progress has apparently been made on 'Plastoprene' during the course of the last year. The company also demonstrated the use of zinc dust in anti-corrosive paints.

Techne (Cambridge), Ltd., showed a modified version of their industrial viscometer. This model was a micro-viscometer needing only 0.7 ml. of sample. A gelation timer and new water bath, as well as a reflecting microscope of a new type were also on view. The water bath had a new thermostat and a Sunvic electronic relay to maintain it within a few hundredths of a degree.

British Geon, Ltd., used the exhibition as the first opportunity to announce a new resin. This is Geon Resin 400X150, a modified vinyl resin of high molecular weight recently developed in the company's research and development laboratories. In a publication issued by the company at the exhibition, in which solution characteristics of their range of resins are published for the first time, provisional figures show that the new resin has interesting solution properties. A comparison of these properties with those of Geon Resin 205 is given below.

Solubility (g. polymer per 100g. solution	Geon 205	Geon 400 X 150
Xylol	4.0	0.5
Acetone	16.2	23.2
MEK	11.0	28.7
MIBK	12.3	17.2
50/50 acetone/xylol	21.3	25.8
50/50 MEK/xylol	15.9	26.4

Shown on the company's stand were the properties of the 400 series and the 200 series of resins, together with such applications for their resins as PVC leathercloth, oilskins, and the 'cocoon' type of preservation used to protect ships laid up in reserve. In this process, the covering consists of six layers. Tapes cover the equipment first, followed by



The model coke-oven plant shown by the National Coal Board

The stand of Monsanto Chemicals, Ltd., showing their diagrammatic representation of 'Aroclor' structure

a webbing coat and two coats of plastic. A bituminous coat follows this, and an aluminised coat is applied on top of all. Inside the 'cocoon' a desiccant is placed to ensure dryness.

British Industrial Solvents displayed an interesting and instructive stand which gave details of the physical testing of solvents and plasticisers for the surface-coating industries, and possible errors that could creep in through faulty technique. These errors are many and varied. Some demonstrated could occur in the determination of the initial boiling point of a mixture.

Honeywill & Stein depicted diagrammatically the origins and applications of shellac and the use of various anti-skinning agents such as dipentene. The Zinc Pigment Development Association showed examples and photographs of the exposure tests applied to paints in varying parts of the country, as well as standards and graphical data used in interpreting the tests.

British Resin Products, Ltd., had an attractive stand showing the production of emulsion paints for surface coatings. The combination of wetting agent, sequestering agent and de-foaming agent with the colloid solution and pigment gives a pigment paste which, when added to the plasticised polystyrene dispersion, produces the emulsion paint. The process was demonstrated by interconnected beakers of the various products which were stirred mechanically for effect.

The National Coal Board had erected a simplified and ingenious model of a coke-oven plant showing the production of various coal by-products related to the oil and colour and other industries. Passage of the products was shown by means of glass tubing containing coloured liquids through which a stream of air bubbles flowed.

Fractionation of oil and varnish polymers is an essential operation if knowledge of the chemical structure of drying oils and varnishes and of oxidation processes during heat treatment, etc., is to be gained. The stand of the Paint Research Station featured various methods of carrying out this separation, including distillation, low temperature crystallisation, chromatography and so forth. Infra-red spectroscopy was also demonstrated.

Monsanto Chemicals, Ltd., had an attractive stand as can be seen in the accompanying photograph. Representative of their products were the 'Aroclors'—synthetic oils and resins used as plasticisers, the 'Santicizers'—a range of speciality plasticisers used in the manufacture of decorative and protective coatings, and various preservatives and other products. A photograph showed the effect of 'Santobrite' on the inhibition of

growths on plaster. Benzoic acid as an anti-thixotropic agent was also depicted.

A range of high-performance grey lead paints based on metallic lead was shown by Spelthorne Metals, Ltd. The lead in the paints is produced from ingot lead in the form of a paste in oil, the average particle size being less than one micron. The lead pigment, say the company, consists of more than 99 per cent lead, the remainder being mostly oxygen, and its suspension is stable. Advantages shown on the stand were its excellent brushing characteristics, and, principally, its rust-inhibiting qualities. Metallic lead coverings exclude as well as inhibit corrosion-forming agents such as oxygen, carbon dioxide or water, and form an excellent protective coating.

The Stanley Hall, the second room, contained several stands exhibiting equipment. Vickers-Armstrongs, Ltd., showed its two smallest batch grinding mills for paints, printing inks and kindred products, the 6-in. Uniroll Mill and the B. & G. Box Frame Type Three-Roll Mill fitted with water-cooled chilled iron rollers. Unicam Instruments (Cambridge), Ltd., exhibited equipment designed to aid the specialist in the examination of both raw materials and final product. The Unicam Powder Camera was displayed for investigating molecular structure and physical characteristics of compounds in powder form, and also the firm's spectrophotometers. An interesting type was the SP.500 Quartz Spectrophotometer covering both visible and ultra-violet ranges of the spectrum. The instrument has a reflectance attachment which permits colour comparisons within fine limits and specification of the spectral distribution of the colour concerned.

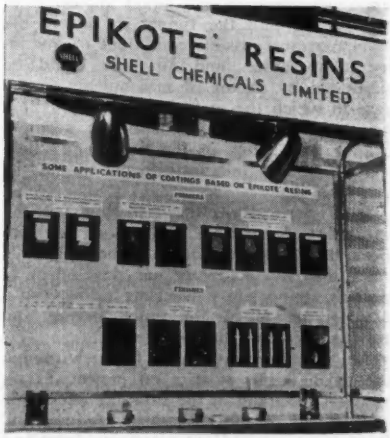
The Pascall Engineering Company displayed their triple roll mills and the 'Inclyno' Test Sieve Vibrator for use in screen analyses. W. Edwards & Co. (London) showed many varieties of vacuum equipment for use in the colour industry, mainly for distillation and filtration, etc. A combined compressor and vacuum pump on the stand gave a pressure of up to 15 lb. p.s.i. and a vacuum of 28 in. Hg. Townson & Mercer displayed, among other instruments, a salt spray cabinet with no metal parts, and a thermostat bath which was a modernised version of their viscosity bath.

The stand of Petrochemicals, Ltd., contained examples of products in their

Petrochemicals' stand

'Catarex' range—which includes xylene, aromatic solvents of various kinds, flow improvers, glycols, resins and specially modified alcohols. Characteristics and applications of some of these were demonstrated as well as a flow diagram of the way they are obtained.

The Hercules Powder Company had a toy electric train running round and round trailing containers labelled with various products of the company. The Geigy Company (Pigmentary Colours Division) were showing a few speciality and standard pigments for the paint, printing ink, rubber and PVC industries.



The stand of Shell Chemicals, Ltd.

National Titanium Pigments, Ltd., demonstrated the various stages in the production of a high-quality pigment

Vinyl Products, Ltd., displayed a number of specialised aspects associated with the use of their 'Vinamul' PVA emulsions.

Featured on the stand of Howards & Sons, Ltd., was a completely new instrument for determining evaporation rates. Designed by the company, this worked on the principle that a funnel full of liquid—exposing a known surface—evaporated, and the resultant downward movement of a float caused a burette tap at the top of the instrument to open and allow enough liquid to flow from the burette into the funnel to restore the level. Various possible conditions of humidity, temperature, and air flow could be simulated by means of attachments to the case in which the meter was housed. There has long been a demand for an accurate evaporation meter in the paint and allied industries, and this instrument should be very useful.

In Victoria Hall, the last room of the exhibition, there were 18 firms represented. Beck, Koller & Co. showed a new phenolic resin that the company has developed, as well as amino and plasticising resins, and a new drying alkyd for quick drying and stoving industrial finishes.

An ingenious apparatus for determining the drying time of inks on paper was on view on the stand of the Printing, Packaging and Allied Trades Research Association. Prints were mounted on a rotating drum and a loaded stylus pressed a sheet of clean white paper against the prints at regular intervals. Also present was an apparatus for demonstrating the cavitation induced in liquids by rotating rollers.

A. Boake, Roberts & Company featured examples of the wide range of metallic stearates manufactured by them. In an attractive exhibit the production of the stearates of aluminium, barium, lead, calcium, lithium and zinc from their raw materials was indicated, as well as their uses. Evans Electro-selenium showed several of their photoelectric instruments including the 'Eel' Glosshead and Reflectance Spectrophotometer. The Watford Chemical Company exhibited a range of esters used as oil additives for lubricants, including the oleates of glycerine and pentaerythritol and various glycols. Pentaerythritol, when used to replace glycerine in resins and drying oils gives greatly improved weather-resistance, chemical resistance and drying time.

Asssociated Lead Manufacturers, Ltd., displayed recent developments that have taken place in lead pigments, new and old, and their uses in different types of paint. Special chemicals and zirconium products were also featured.

The A.P.V. Company showed with photographs and actual samples, specimens of argon arc, metallic arc, and double operator gas welding techniques, in the preparative, welded, and polished stages. Applied

[*continued on page 591*

MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Ultramicroanalysis

Past, Present and Future—(Concluded)

At a recent meeting of the Midlands Society for Analytical Chemistry held in Birmingham, Dr. C. L. Wilson, Reader in Inorganic and Analytical Chemistry, Queen's University, Belfast, delivered a lecture entitled 'Ultramicroanalysis—Past, Present and Future'. In our issue of last week we published the first half of our report of this lecture, and the remainder follows:—

THE techniques and apparatus devised for ultramicroanalysis by Benedetti-Pichler and his co-workers (described last week) have been further extended and developed at Belfast. Certain pieces have been replaced by more suitable apparatus, although many of the classical ideas are retained. Unfortunately, a wide gap in the literature exists between the development of ultramicro-techniques just prior to the war and immediately after it.

Among the more important ultramicro-analytical apparatus is the micro-manipulator of Wigglesworth and others. A similar instrument has been conveniently constructed at Belfast from the rack and pinion movements of three discarded microscopes, providing motion in three directions at right angles. Thus, a pipette, attached to a syringe and mounted on the manipulator, is brought into the working capillaries by the appropriate movement of the activating spindles. Further modifications of the manipulator have enabled rapid or slow movement to be obtained in the most suitable directions by means of coarse and fine adjustment screws. The pipette tip may be rapidly brought into the approximate position prior to the introduction or removal of reagent and then the activating mechanism locked; by turning the fine adjustment screws the pipette tip can be safely guided into the reaction capillary.

Construction of Pipettes

The pipettes are constructed of glass and consist of a stem 2 cm. long, of 8 mm. external and 6 mm. internal diameter, a shank 12-15 cm. long and about 1 mm. external diameter with a tip of about 8 mm. length and 20-25 bore. They are made by drawing ordinary glass tubing to a uniform capillary in a Bunsen flame and completing the construction in a micro-flame. The pipette from its tip to a few mm. of the shank is coated with a water-repellent substance to minimise the interference of surface-tension effects in the hair-tip capillary. Paraffin wax was tried, but although this material proves satisfactory in ordinary microanalytical techniques, its use on the ultramicro scale has serious disadvantages, especially in gravimetric work, where there is always the danger of a particle of wax being dislodged and contaminating the precipitate. 'Akard'—a partially polymerised phenol-formaldehyde resin—gives a satisfactory coating.

Hair Tip Retained

The pipette tip is so constructed that about 1.5 cm. of hair tip is retained, and about 0.5 cm. of the tip is immersed in an ethanolic solution of the resin; suction is applied until sufficient liquid enters the pipette. The liquid is then expelled, and the pipette, after evaporation of the ethanol, is baked in an electric oven for two hours at 140-150° C. The excess portion of the tip which is externally coated where contact has been made with the liquid, is cut off so that only the inside of the pipette is resin-coated. This is essential since precipitates tended to cling to the externally coated surface.

Superior coatings can be obtained, however, with 'Teddol'—a liquid containing mixed methyl chlorosilanes. The pipette is simply immersed in the liquid, suction applied to draw the liquid into the shank and finally the liquid is expelled. The pipette requires no further treatment.

The pipette is used in conjunction with an 'Agla' micrometer syringe and attached to it by means of a piece of stout rubber tubing. The syringe is filled completely with water so that operating the micrometer screw results in the expulsion or introduction of reagent because of the hydraulic pressure exerted on the air in the main body of the

pipette. This provides a more convenient and satisfactory arrangement than that originally used by Benedetti-Pichler. The pipette and syringe are then rigidly clamped into position on the micromanipulator by means of two spring clips.

Moist Cell Used

All reactions are carried out in a moist cell containing a platform or carrier for holding the micro-reaction cones. The cell is made a suitable size for convenient fastening to the mechanical stage of a microscope, and is constructed of 'Perspex' and glass. The base and three sides are of 'Perspex', the fourth side being left open; the top of the cell is of thin glass, a sheet of which can be slipped into position along grooves near the top inner surface of the three 'Pespex' sides. Around the four sides of the base, filter-paper strips are placed and kept soaked with water to maintain a sufficient degree of humidity within the cell. Horizontal strips can also be placed against the three closed sides of the cell but these are not altogether essential as sufficient humidity is maintained without them.

The carrier or platform, on which the reaction and reagent vessels are held, is made from a glass block built up from several pieces of microscope slide cemented together with a suitable transparent adhesive. The surface area of the platform is about 2×2.5 cm., but it has been found convenient to construct the base of the carrier from a rather larger piece of glass to provide a more stable base and a means of ready manipulation. The size of the carrier is by no means critical and may be varied according to space available within the moist cell.

The reagent vessels are normally held on the carrier by a thin film of vaseline, especially in qualitative work. However, in gravimetric estimations, a firmer hold on the vessels is desirable and this is readily achieved by means of a rubber band running tightly round the carrier, parallel to and a few mm. from its front-edge. The 'tails' of the vessels are then firmly held under the band. The working vessels—micro cones and reagent containers—are constructed from capillary tubing of about 1 mm. diameter, by softening a small length of the capillary about its mid-point until a solid bulb of glass is formed; on carefully drawing this bulb, a solid rod of glass is obtained between two pieces of the capillary. About 2-3 mm. of the capillary, with a tail or handle of solid glass about 1 cm. long, is retained for micro cones; the reagent containers are somewhat longer, about 0.5-1 cm. of capillary providing the working part of the vessels. The extreme end of the handle, where it is cut, is rounded off to a tiny sphere in a micro flame to minimise the risk of splintering and loss of glass during the centrifuging of gravimetric precipitates. Cones are always handled with extreme care, a pair of forceps being kept specially for this purpose and stored in a closed tube when not in use. Measuring capillaries are made from capillary tubing of a uniform bore of 0.3-0.4 mm. Suitable lengths (1-1.5 cm.) are sealed at one end and stored in closed containers. The bore of each set of capillaries is accurately measured and the volume contained in unit length calculated from this measurement.

All the reactions taking place in the moist cell are observed by means of a compound microscope fitted with a rotating mechanical stage, an eyepiece of X6 magnification carrying a calibrated micrometer scale, and a 32 mm. objective lens, an overall magnification of about X30 thus being achieved.

While the apparatus already mentioned can be used for qualitative, semi-quantitative, and even volumetric microgram analysis, further development of this branch of chemical technique depends on the existence of satisfactory gravimetric procedures. For the complete utilisation of microgram anaylsis a reliable balance is, of course, essential. Not only has this balance to require a not too specialised or rigorous technique for its use, but also it has to be constructed at a reasonably low cost.

Kirk's Microgram Balance

The torsion-restoration type of microgram balance designed and constructed by Kirk, *et al.*, and described earlier, is perhaps the most refined of existing microgram balances. Although this balance shows by far the best relationship between load and sensitivity, its construction is elaborate and expensive, especially where the beam assembly is concerned. The problem thus resolves itself into producing a simplified balance of this type which requires the least expense and construction, and using it for the development of gravimetric techniques other than

those carried out directly on the balance pans, as described by Kirk.

The balance finally devised is very similar to the Kirk instrument but differs from it in certain respects. The first of these is the optical system. The original balance employed a comparison microscope, but in the modified balance the image of the ends of the beam is carried by means of telescopic and prismatic systems on to a horizontal ground glass screen in such a way that the images of two ends of a reference fibre lie side by side and slightly overlap when the beam is in the zero position. All observations have to be made in a darkened room as the illumination from this system is rather weak. The pan stirrups are permanently attached to the beam by means of vertical fibres. It is not satisfactory to employ hooks on these very fine fibres, as, under these conditions, the loads which can safely be carried are necessarily small. A further change is the permanent fixing of the pans in the pan-stirrups.

The fibres used in the construction of the balance differ somewhat from those of the Kirk instrument. The main torsion fibre is reduced in diameter and the length increased. The beam supports are small pieces of razor blade. However, the most radical difference is the method of joining the fibres of the beam assembly. Very neat joints are obtained by using a solution of 'Durofix' in amyl acetate, and are almost invisible to the naked eye. The beam assembly is strengthened by the inclusion of two additional side members. The completed balance may be constructed at a cost certainly not greater than £100 and from readily accessible materials. [The construction of this microgram balance is described in the report of a symposium on microbalances, R.I.C. Monograph 1950, No. 4].

Favourable Performance

The performance of this balance compares very favourably with the Kirk instrument. With a torsion fibre of 16 μ diameter, the sensitivity is approximately 2.25 millimicrograms per minute of arc, compared with 5 millimicrograms on a 25 μ fibre in the Kirk balance. The safe load-difference on the pans can only be obtained by breaking the fibre. However, one such balance stood up to the application of at least eight revolutions of the calibrated dial, which correspond to a load-difference of about 400 μg, 100 μg more than the similar safe load-difference given by Kirk and co-workers. The balance is considerably more robust and can be used without difficulty on general technique by any competent analyst.

The methods used in microgram analysis are divided into three classes. Qualitative analysis requires little apparatus; indeed, the identification of minute amounts of material brings few new problems to the micro-analyst. Secondly, there are semi-quantitative estimations which provide new methods and techniques. Extension of the work of Benedetti-Pichler provides a means for the semi-quantitative estimation of many ions.

Gravimetric Determination

The main advantage resulting from the development of a suitable microgram balance is the possibility of its use in quantitative gravimetric determinations, which form the third class of ultramicroanalytical methods. The processes involved in a simple gravimetric determination consist of five distinct operations. These are: selection and preparation of the micro cone, weighing the cone, precipitation, treatment of precipitate and final weighing of cone and precipitate.

The first operation requires the selection of two micro-cones, the one larger than the operating one being used as permanent counterpoise on one balance pan. Counterpoising of both cones is completed, and the operating cone transferred to a drying capillary and heated in the narrow hole of a heating block to a temperature at which the precipitate is subsequently to be dried. The cone is then returned to the balance pan, and, after acclimatisation of the balance, weighed by the recommended technique. The cone is placed on the carrier, which, is first equipped with a measuring capillary and reagent containers, and, finally, the carrier is returned to the moist cell.

A reagent container is filled with the solution containing the sample and rapidly placed on the carrier. The cell assembly is then brought into focus under the microscope and an approximate volume of sample solution delivered from the reagent container to the measuring capillary, whereupon the length of liquid column is immediately read. The measured sample is then transferred to the cone using the pipettes. Precipitation of the ion is effected by addition of the requisite reagents in suitable amounts, calculated from the bore of the reagent containers. The cone is transferred to a centri-

fuging capillary open end first and the capillary placed in a small cone of the type used in qualitative micro-methods, so that on raising this cone to the vertical position, the handle of the micro cone rests on the bottom of this cone, while the micro-cone remains inside the capillary.

After centrifuging, the microcone is carefully allowed to drop out of the centrifuging capillary and is replaced on the carrier. The supernatant liquid is separated using the pipette, care being taken not to disturb the precipitate. The wash liquid is then added and allowed to remain in contact with the precipitate for an appropriate time. Several washings are made, in each instance without disturbing the precipitate, and finally the cone is transferred to a drying capillary, and dried.

On a Sound Basis

The determination is completed by weighing the cone and precipitate. The precisions of such determinations of inorganic ions by these techniques are about ±0.7-0.8 per cent on samples containing approximately 10 micrograms of the ion being determined, thus placing ultramicro methods on a sound quantitative basis.

The further development of ultramicro-analysis should be evident in many fields of both pure and applied chemistry. The isolation and analysis of mineral grains in rocks and ores, the examination of metallurgical products and the investigation of the problems of corrosion, can be instanced as fields which will undoubtedly benefit from the extension of microgram methods. Many physical methods such as those involving the spectrograph or similar specialised physical equipment, may be replaced or supplemented by microgram methods, especially where accurate analyses are required.

The development of the microgram balance may result in the extension of quantitative organic microanalytical techniques to the microgram scale, for it is evident that microgram combustion methods will provide suitable means for the determination of the elements in rare and expensive biological compounds. In the biological field there are innumerable instances where the sample size limits convenient analysis even by the conventional methods—for instance, in the examination of small amounts of body fluids. The comparatively new field of isotope chemistry depends a great deal on ultramicro techniques, not only because small amounts of these isotopic substances are available but also because the intense radioactivity of these elements prevents their examination in any other than microgram amounts, if the analyst is to be safe from the harmful radiations. This is perhaps, one example where amount of material is not the controlling factor in analysis.

The development of a microgram balance with a wide load range increases the attention given to what may be termed 'semi-microgram' analysis. At present there exists no real definition of this category. No well-defined methods have been described between milligram and microgram techniques, although either of the two procedures may be extended to fill this intervening gap.

It is apparent that microgram methods are more suited for adaptation on an upwards scale than milligram methods are for scaling down. Thus, with a balance combining large load with high sensitivity, the precision of gravimetric determinations can be improved by increasing the amount of sample to about 50-100 micrograms, using correspondingly larger apparatus than that described for microgram amounts. This constitutes semi-microgram analytical techniques.

'Ultramicrogram' or submicrogram analysis, dealing with amounts of the order of 10^{-9}–$^{-10}$ g. may also provoke interest in the future. The introduction of microgram analysis as a practical possibility in a normally equipped analytical laboratory augurs well for the future of ultramicrogram analysis.

'Celanese' Plastics on Show

ADEQUATE protection for the thousands of workers operating industrial equipment and machinery, compatible with the maximum degree of mechanical efficiency, is an important problem, and British Celanese, Ltd., are giving considerable publicity in the trade and technical Press and in their plastics exhibition at Celanese House to the use of 'Celastoid' Sheet and 'Celastoid Wireweld' (wire-mesh reinforced sheet)—transparent and shatterproof materials—for safety applications. The exhibition, 'Development in "Celanese" Plastics' will be open from 28 April to 16 May—concurrently with the British Industries Fair—and is to be held at Celanese House, Hanover Square, London, W.1. Tickets may be obtained on application to British Celanese, Ltd.

The Analytical Chemistry of Potassium

Part III : Physical Methods

by J. W. ROBINSON, B.Sc., A.R.I.C.

THE use of physical methods in analytical chemistry is becoming widespread, particularly for routine work. It is not surprising therefore that these methods have been applied to the determination of potassium.

Chromatography

Chromatographic methods in analytical chemistry have become so commonplace that a description of the principles involved would be superfluous.

The two principal methods used are the packed column and the use of paper strips. Both have been applied to this field.

In a review of inorganic chromatographic applications, Robinson[1] describes Erlenmeyer and Dahn's[2] work in which 8-hydroxyquinoline was used as an adsorbent in the packed column form. He also quotes Erlenmeyer and Schmidlin[3] who used violuric acid to detect the sodium (red band) and 5-oxy-4-oxamino-3-phenyl*iso*oxazoline to detect the potassium (yellow band).

Beukenkamp and Rieman[4] used a column of colloidal 'Dowex 50' and 0.7 N hydrochloric acid as an eluent. They claimed complete separation of sodium and potassium.

Hopf[5] developed the work of Floods[6] on the separation of the alkali metals. In the method he proposed a filter paper treated with starch and then violuric acid to detect the metals, according to the Erlenmeyer method[2]. This was spotted with a known volume of the mixed alkali solution (in 2 per cent acetic acid solution) when a separation took place. A red, inner sodium zone was obtained, followed successively by a pink potassium zone and a blue ammonium zone.

By measuring the radii of these zones and applying Floods' formula, the analysis of the original spot was obtained.

In his work Hopf worked on samples of known composition, and proved the validity of Floods' formula.

Burstall, Davies, Linstead and Wells[7] recommended the use of paper strips for the separation of the alkali metals and used methyl alcohol as a solvent. They claimed complete separation of sodium, lithium and potassium.

Chromatographic separation enables a separation of alkali metals at the expense of some little time. It must be remembered, however, that even after the separation, an accurate determination has to be carried out, since the measurement of band width or depth affords only a very approximate answer.

Organic Exchanges

This method is very similar to the chromatographic technique in underlying principles. Kayas[8] investigated the use of Amberlite I.R. 100 which he found quite effective as an agent for separating sodium and potassium. His original paper describes how the sample was first mixed with a little magnesium and was then bombarded with deuterons causing the formation of sodium-22. This was used to tag the sodium of the original sample since it is easily detected by its radioactivity.

The Cyclotron

In addition to Kayas' paper[8] the use of the cyclotron has been described by Boyd[9] for the estimation of potassium in rubidium. The sample was irradiated with deuterons, giving rise to radioactive isotopes of potassium. This radioactivity was measured. From this the potassium content was calculated.

Radioactivity Methods

The natural radioactivity of potassium has led to the widespread use of the Geiger counter as an instrument for determining potassium concentration. When the instrument has been calibrated and corrections have been applied for the geometry of the sample the counter has become a useful tool to the mineralogist and agricultural chemist.

A simple procedure for calibration has been outlined by Gaudin and Pannell[10] who used screened potassium chromate as a standard.

A rapid method for determining potassium in glass has been evolved by Eklund[11] who assumed that potassium-40 was 0.012 per cent of the total potassium present. Sue[12] has proposed a method for the determination in the presence of lithium, and Tiratsoo[13] has described a procedure for the analysis of

petroleum residues, also based on this.

Burch, Reaser, Ray and Threefoot[14] have described a general micro method. The solution sample is delivered with a micro pipette on to a filter paper disc. This is then air- or oven-dried and cemented on to a tin-coated metal disc placed in a special holder for counting the rate of emission. They claimed an error of 0.39 per cent.

Although the measurement of the radioactivity of a sample would seem to give rise to a rapid method of estimating potassium, there remain two obstacles to be overcome before the method becomes accurate. The first is that the sample must have the same geometry as the standard used to calibrate the instrument, and secondly, the Geiger counter is not quite as accurate a guide of the radioactivity of a sample as might be desired. However, providing the potassium content of a sample is not required to within fine limits, its application is quite justifiable.

Polarographic Methods

In recent years polarography has found more and more prominence in analytical chemistry and it is not surprising that its use has been investigated for the determination of potassium. However, only moderate success has been achieved.

Weaver and Lykken[15] put forward a method which required the ratio of sodium : potassium to be previously known.

Okac[16] found that the total amount of alkali present caused a variation in the galvanometer reading and introduced an error.

Vanderbosch[17], however, claimed to have produced a satisfactory method intended primarily for glass analysis. The alkali metals were determined in the presence of tetramethyl ammonium hydroxide — $N(CH_3)_4OH$ and phosphoric acid. He does not, however, state the accuracy of the method.

The Spectrograph

This instrument, which measures a purely physical characteristic, has recently come into prominence. The principle used is that the specimen gives rise to light of certain characteristic frequencies to be generated in a flame or arc. A beam of such light is passed through a prism and falls on to a photographic plate. From the position and intensity of the lines the analysis of the sample can be calculated.

Fruitful work has been carried out on uranium-base materials by Scribner and Mullin[18] who claim results accurate to within 2 per cent. Helz and Scribner[19] also reported rapid and accurate results in the analysis of Portland cement.

Other workers, however, have not been so successful. In the analysis of silica brick, for example, Rozsa[20] claims an accuracy of 5 per cent and in silica refractories, Hirdle and Walthorn[21] found that the potassium figure obtained differed by as much as 12 per cent from the standard.

The method has been used successfully by Haycock and Russel[22] to determine potassium in rock salt. Kvalheim[23] has worked out a method for estimating eight common metals found in rock and mineral samples.

A spectrographic method has also been proposed for the estimation of potassium in solution. Dobrinskaya and Gurivich[24] claim an accuracy of 3.9 per cent on a sample containing less than 0.14 mg. of potassium as potassium hydroxide. A similar procedure is put forward by Scanlan[25] but he makes no claim as to the reproducibility of the results.

An ambitious attempt is being made at the University of Ghent by Gillis and Eeckhont[26] to estimate all the spectrographically detectable elements (these include potassium). They have also produced a method for the analysis of clays[27]. Lithium carbonate is added to the sample and lithium is used as a reference material. However, the reproducibility is only between 10 to 15 per cent.

Russel[28] has used this method for analysing brine. He was able to estimate nine commonly occurring elements, including potassium and sodium, by evaporating to dryness, using an A.C. spark and calibrating the curves.

Pfeilsticker[29] applied the method to the analysis of blood. He used a low voltage spark as the light generator, and a sample of only 0.5 ml. He calibrated his curves by synthesising standards whose composition was similar to the sample. This decreased errors arising from interference due to the presence of other materials. He also examined the effect of *p*H on the method and from his findings produced a method which he claimed was accurate to ± 3.4—4.3 per cent.

Fast[30] modified the procedure somewhat when analysing iron catalysts. He used low current D.C. which enabled a two-stage volatilisation of the 100 gm. sample of catalyst. The potassium was volatilised off at

the first stage. He measured the length of the sector line 4047.2 Å, from which he calculated the potassium content of the sample, the concentration of which was between 0.01 to 1.0 per cent of the sample. He claimed a deviation of between 5 to 10 per cent.

Efendiev[31] has also applied modifications to the design of the apparatus and the voltage and currents of the electrical circuits producing the arc.

The main difficulties to be overcome before this method becomes accurate include the exact measurement of the line produced on the photograph, and the presence of other compounds and elements in the sample solution, since these affect the intensity of the line produced to a considerable degree. Pfeilsticker[29] eliminated this to some degree by calibrating with a standard similar to the specimen in all respects. This, however, limits the method and considerably increases the time taken for a determination.

The Flame Photometer

The flame photometer is also a physical method based on the light of a characteristic frequency generated by a sample in a flame.

In this method the required frequency is singled out by suitable light filters and the intensity measured by a photoelectric cell or light gauge.

One of the most active workers in this field is H. Riehm, who with his co-workers has produced the Riehm-Lange[32] apparatus. He used an acetylene-air or illuminating gas-air flame as the source of light.

His method has been used by Herrman and Lederle[33] for lactate analysis and they claimed a 5 per cent accuracy. He produced a method himself for the analysis of lactates[34] and claimed good results although Gyorgy[35] examined the method and was unable to obtain good results.

Among other active workers in this field we find Attoe and Truog. Their work has been mainly concerned with biological material. In the analysis of plant tissue they claim potassium results which differed by 2.6 per cent from the figure obtained by the cobaltinitrite method[36]. They also used the method for the direct analysis of soils and claimed that these results were within 2.2 per cent of the figures obtained by the cobaltinitrite method[37].

Miles[38] studied the method and compared it with the cobaltinitrite method, and stated that the results obtained by flame photometry were not so accurate as those obtained by precipitation as potassium sodium cobaltinitrite.

The main advantage of the method is its speed. Rogers[39] states it is possible to carry out routine determinations at the rate of one element/minute/sample. He was in this case using an acetylene-air flame and a quartz photoelectric cell.

This high rate of working has resulted in intensive research on the application of the method in many fields, and simultaneously on improvements to the apparatus. As with the spectrograph, other elements and compounds interfere with the intensity of the light produced and work has been done to overcome this. Myers, Dyal and and Borland[40] introduced a modification which, they claimed, eliminated the necessity to burn away organic matter.

West, Folse and Montgomery[41] claimed to have eliminated the effect of other elements by using water saturated successively with sodium, calcium and magnesium chlorides. Their method was designed primarily for water analysis and was suitable for values between 0 and 100 p.p.m. They claimed that the results compared well with those obtained by classical methods.

Sedlacek and Valicek[42] modified the apparatus by using a spray diffuser, light filter and a caesium photoelectric cell. By this means they claimed that the influence of other cations was eliminated and that only the line K 7665 Å and 7699 Å remained.

Proehl and Nelson[43] when analysing biological liquids claimed to have overcome the adverse effects of viscosity, urea, phosphates and glucose by simple dilution. They do not, however, state the accuracy of the results obtained.

Work has also been done on the design of the apparatus itself, Bills, McDonald and Niedermeier[44], also Peter and Kreissig[45] have introduced circuit modifications. Weichselbaum and Varney[46] have introduced a new sample atomiser and Monvoisin and Mavrodineanu[47] have improved the design by dispersing the flame with a supersonic oscillator built into the jet. The flame is stabilised by heating the fuel inlet at the base of the flame. Their apparatus was designed primarily for the estimation of potassium in silica-alumina refractories.

Hallman and Leppanen[48] used an apparatus similar to the Wallace type, but a con-

stant quantity of lithium was added to the unknown solution as an internal standard. They obtained an accuracy of ± 1.98 per cent from a sample of 0.2 mls.

The flame-photometer has been applied to a large extent in blood and biological fluid analysis. According to the method of Willebrands[49], the serum is diluted a hundredfold with water and is sprayed into a colourless flame. They used a special photoelectric cell for the operation and stated that the lines K 7665 Å and 7699 Å were the best to measure. The accuracy obtained was within 2 mg. potassium/litre of serum. Willebrands[50] reviewed the use of the flame photometer in blood analysis and lists 22 references. Bernstein[51] gives a description of the internal standard flame photometer as used in serum analysis for sodium and potassium. Keirs and Speck[52] used this apparatus for milk analysis and used standards slightly above and below the unknown and interpolated the results. The method has also been used for wine analysis[53] and is accepted as the standard method for determining potassium in cement[54].

Eubank and Bogue[55] investigated the accuracy of the apparatus using a Perkins-Elmer model type 52A. They checked the results obtained by (1) gravimetry, (2) emission photometry with lithium carbonate as an internal standard, (3) direct emission with calcium oxide, hydrochloric acid solutions with known amounts of potassium present.

For samples containing between 0.2 and 0.8 per cent potassium the variation between (1) and (3) was 0.024 per cent; the variation with (2) was even less.

A complete description of the construction and operation of the flame photometer is given by Domingo and Klyne[56].

It can be seen from the foregoing review of the flame photometer that it is becoming a very popular instrument for the estimation of potassium. However, modification still remains to be done before exact results are obtained, but the speed of operation has proved a great stimulant to further research.

Spectrographic—Photometric Method

This is a direct combination of the spectrographic and photometric methods and has been devised by Heidel[57] primarily for soil analysis.

In this method the light passes through a prism as in the spectrograph and the intensity is measured on a photoelectric cell as in the photometer.

Several metals may be determined simultaneously and with reasonable accuracy. In the paper quoted, these are calcium, magnesium, sodium, potassium and manganese. This principle gives promise of being even more rapid than the flame photometer since several elements may be determined simultaneously. The same difficulties encountered with the photometer need to be overcome in this case before the method becomes exact.

It would seem that to date, physical methods are more rapid, but not so accurate as the classical precipitation methods, but the accuracy obtainable is improving.

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A 'Parliament of Science'

British Association's Belfast Programme

A WIDE range of scientific information of interest both to the expert and the layman will again be provided at this year's meeting of the British Association for the Advancement of Science of which the preliminary programme has now been issued.

The 'Parliament of Science,' as the annual meeting has sometimes been called, will this year be held in Belfast from 3-10 September. Now that scientific research is so largely supported directly and indirectly from public funds these meetings have assumed new importance as one of the main occasions when the scientists have the opportunity to report progress to the public.

A special graduation at which Honorary Degrees of the Queen's University will be conferred will precede the inaugural meeting which will take place on the evening of Wednesday, 3 September, in the Whitla Hall, when Professor A. V. Hill, C.H., O.B.E., F.R.S., will deliver his presidential address on 'The Ethical Dilemma of Science.'

Sections of the association will begin their sessions on the morning of Thursday, 4 September. The Chemistry section (Section B) will be accommodated in Queen's University. 'The Advancing Front of Chemistry' will be the theme of the section's presidential address by Professor W. Wardlaw, C.B.E., and the subsequent papers and discussion.

Other subjects which will be discussed by section B include: Fibres old and new (Friday, 5 September); food processing (Monday, 8 September); and the chemistry of biological inhibitors (Tuesday, 9 September).

In the Physics section (Section A), the president, Professor A. M. Tyndall, C.B.E., F.R.S., will open the session with his address on 'Recent Contributions to Experimental Physics from Britain.' Other topics for discussion in this section will be electrical discharge in gases and moisture relations and fibre processing.

An interesting range of general excursions is being arranged and there will also be some 40 afternoon visits to factories and other industrial establishments broadly representative of the range of industry in Ulster. Sectional excursions include, for chemistry, visits to the Linen Research Institute; Gallahers, Ltd.; Ormeau Bakery, Ltd.; and Courtaulds, Ltd.

Three evening discourses will be given during the period of the meeting. Mr. A. C. Hartley will speak on an engineering subject (5 September); Professor A. Macbeth on a philosophical subject (7 September); and Sir William Slater on science in agriculture. Admission will be by membership ticket, and the discourses will be at 8 p.m. in the Whitla Hall, Queen's University. There will also be five lectures for young people.

It is hoped that Dr. D. W. Bronk, president of the American Association for the Advancement of Science will be able to attend the meeting and that he will deliver the British-American Association Exchange Lecture.

Scientific films will be used to illustrate individual papers and lectures while a programme of scientific films will also be arranged by the British Universities Film Council.

Officers of Section B—chemistry—will be: *President*: Professor W. Wardlaw, C.B.E.; *vice-presidents*: Professor Wesley Cocker, Dr. A. J. Turner, C.B.E., Professor Ubbelohde, F.R.S., Professor T. S. Wheeler, R. Clement Wilson; *recorder*: Professor L. Hunter, University College, Leicester; *secretaries*: Dr. J. Dewar and Dr. D. C. Martin; *local secretary*: Dr. R. C. Pink.

German Chemicals Hit

Synthetic Fibre Production Stepped Up

TWO sharply contrasting tendencies mark the outlook for the German chemical industry. The stagnation in many consumer industries, especially the textile trades, has been severely felt by manufacturers of dyestuffs and similar products, both in the home market and in export sales; the latest reports suggest that the falling-off of demand from abroad is even more marked than the decline in the domestic trade. On the other hand, there has been a noticeable improvement in the demand for fertilisers.

Supply Position Improves

The raw material supply continues to improve. Most chemical manufacturers receive their full quota, and more, of home-produced coal, and though the production of coal derivatives is still kept down by limitation of plant capacity, outputs have risen of late. The medium-pressure part of the Fischer-Tropsch plant at Wanne-Eickel, which is owned by Krupp Kohlechemie GmbH, has been in operation since early March; special attention is paid to the production of hard paraffins.

The reorganisation of the I. G. Farbenindustrie and the formation of successor companies have not yet been completed, but several of the new firms have already announced plans for the future. Badische Anilin- und Soda-Fabrik AG, Ludwigshafen, entered the current year with a labour force of 26,500—about the same as before the war. The turnover, which amounted to Dm. 262,000,000 in 1949, and Dm. 482,000,000 in 1950, rose to Dm. 680,000,000 last year and is expected to increase still more, although, as existing plant is already fully in use, further progress depends on more reconstruction, and also on research, which is stated to 'find greater scope only gradually'. Last year fully one-third of the output was exported. Sales consisted of about equal parts of organic and inorganic basic chemicals, fertilisers and other nitrogenous compounds, plastics and lacquer materials, and dyestuffs and other chemical products.

Of the smaller I. G. Farbenindustrie units, Dr. Alexander Wacker, Gesellschaft für Elektrochemische Industrie GmbH, Munich, intends to remain entirely independent. The company last year started the production of silicones and is also prominent as a producer of solvents for the lacquer and plastics industry, and of acetic acid.

Other I. G. Farbenindustrie units in Bavaria, however, notably Kunstseidenfabrik Bobingen and Lech-Chemie, Gersthofen, appear to favour closer links with Farbwerke Höchst, Frankfurt, one of the three major companies which have emerged from the reorganisation. Kunstseidefabrik Bobingen has drawn up a Dm. 25,000,000 modernisation programme, chiefly for the expansion of its 'Perlon' production. Dm. 7,000,000 are to be spent on increasing the 'Perlon' staple fibre output to 15 tons a day, and a slightly larger sum may be expended on the erection of a 'Perlon' filament plant. Co-operation with Farbwerke Höchst would ease the raw material problem and possibly also facilitate financing expansions.

The works at Dormagen have been left with Farbenfabriken Bayer, Leverkusen, for similar reasons. Dormagen depends on the Bayer works at Uerdingen for its supply of caprolactam for the production of 'Perlon'. At present the monthly production of 'Perlon' fibre at Dormagen is about 60 tons, and another 50 tons of 'Perlon' bristle are being produced each month. Plans to produce 'Perlon' filament have not yet been put into practice but are far advanced, and chemists at Dormagen have given much attention to other fully synthetic fibres. The company, however, is unwilling to commit itself to substantial investments in this field before investigating all possibilities.

'Perlon' Production

The total German 'Perlon' production last year (excluding the output of the Soviet zone, which is not exactly known, but is certainly small) amounted to about 4,000 tons. It is now running at a monthly rate of over 400 tons. Apart from Bobingen and Dormagen, the Oberbruch plant of Vereinigte Glanzstoff-Fabriken AG is the largest producer, while relatively small quantities are being produced by Rhodiaceta and Spinnstoff-Fabrik Zehlendorf. Cassella Farbwerke Mainkur are working on a poly-acrylic nitrile fibre called PAN, based on work begun long before the war. Work on the pilot-plant scale was completed early this year, and efforts are now being made to start industrial-scale production as quickly as possible.

Founding a Dye Industry

New Indian Factory will End Dependence on Foreign Sources

BULSAR, a small market town 150 miles north of Bombay, was the scene of the opening ceremony of India's first dyestuffs and pharmaceutical plant ever built, on 17 March. This plant, operating under the name of Atul Products Ltd., constitutes one of the biggest steps forward towards a basic chemical industry which will make India broadly independent of foreign sources of supply. Although it will probably be 20 years before this actually happens, the Atul plant will quite soon be producing enough aureomycin and sulpha drugs to cure most of the infectious diseases which are so serious in India. Folic acid—vital in treating anaemia, is also to be produced. In the field of dyes, the £1,250,000 plant has a capacity of 1,800 tons of azo and sulphur dyes yearly, enough to accelerate rapidly India's textile industry, which has previously been limited to producing grey goods. Dyes used to be imported mostly from Germany, Japan, Great Britain, Switzerland and the United States. Some blending of dyes took place in the country, but the dyes themselves were never directly synthesised from coal tar intermediates.

American Assistance

The Atul plant was built with technical assistance and advice from the American Cyanamid Company, whose vice-president, S. C. Moody, was present when Mr. Nehru, Indian Prime Minister, opened the plant. In a speech, he paid tribute to the late Indian chemist, Dr. Subbarow, whose work at Lederle Laboratories had contributed so greatly to the discovery of aureomycin. As partners, his company are providing technical training, some of the raw materials, advice, guidance on equipment purchase, and ten per cent of the capital. Indian pioneer of the new dye industry is Kasturbhai Lalbhai, owner of the biggest group of cotton mills in Western India. Shares issued by the new company have already been taken up by the Indian investing public and have risen 50 per cent in price before a pound of dye has been produced by the plant.

First product to leave the huge blenders will be sulphur black, key intermediate for 25 of the dyes most widely used in India. Azo dyes, however, will constitute most of the output (1,350 tons yearly). The main part of the dye section of the factory is a three-storey structure, surmounted at one end by a 90-foot tower which houses the ice plant.

The method of manufacture will be in general the same as that employed at the Bound Brook (N.J.) plant of the Calco Chemical Division of Cyanamid. The Atul project will also continue to receive results of laboratory research conducted at Bound Brook. At the same time, Atul has its own research laboratory.

Staffed by Indians

Laboratory and the plant are manned by Indian chemists (some with American college degrees) and trained workers from nearby villages. The man in charge of azo and sulphur dye production is an Indian chemist who worked for 15 years in the Kasturbhai group of mills as consultant on bleaching.

Lay-out of the plant allows maximum efficiency in handling of materials. The 40 tons of ice and 10 tons of refrigerated water required daily by the azo section are supplied by an automatic ice-making machine assisted by a barometric leg vacuum cooler. The ice is fed by gravity to the solution vats on the third floor in which the initial solutions are made up. These are again fed by gravity to the huge 10,000 gallon coupling vats which are set just above floor level on the second storey. All the vats in the plant have been made on the spot by Indian craftsmen shipbuilders from teak cut from the local jungles. Planed by hand and gauged by eye, these vats are thought to be a close equivalent to the precision-made vats of the West. The chemical reaction of teak to the various acids and alkalis used in dye manufacture is not yet known with certainty, and Atul chemists will be watching the vats carefully to compare the teak with the cypress usually employed by the Western construction engineers. The use of teak has cut costs by about half.

After leaving the coupling vats, the precipitated dye flows by gravity to centrifugal pumps which convey the dyes slurries to the

large-size (56-in.) filter presses. The isolated press cake is then loaded into trays and dried in recirculating air truck driers. Finally, the dye is dumped into containers and carried back to the third floor whence it feeds down through the grinders to the blenders and to the finished packages ready for shipment. The sulphur group of dyes, made at the other end of the building, uses similar grinding and blending equipment, but these are dried on drum driers. A third class of dye planned at Atul is alizarin, equipment for which will be housed in a separate building, but under present market conditions in India there is a moratorium on this phase of production.

Cyanamid experts who have helped to build the Atul plant say that production possibilities extend far beyond the present capacity. A natural development will be the production in India of some of the crudes. Benzole, for example, is already made by one Indian firm. One day Atul should be capable of supplying most of the dyes that Indian textile mills and bazaars require. There is plenty of room for expansion in the 850 acres surrounding the plant. American experts point out that it took Cyanamid's Bound Brook plant (founded in 1915) ten years to grow to the present size of Atul, and they see no reason why in another twenty years Atul should not be as big as the Bound Brook plant of to-day. 'Atul' is a Hindu word meaning incomparable. It may well live up to its name.

German Industry on Show

First Post-War Fair in its Own Hall

AT the German Chemical Industries Fair to be held in Hanover (27 April-6 May, 1952) almost the whole chemical industry of the West German Federal Republic will reappear for the first time since the war in its own exhibition hall. Nearly all the big firms, including the majority of successor companies to the former I. G. Farben, and the most important firms of the German plastics industry will present their production programmes by a representative display staged in 'Chemistry-Hall'. More than 100 firms of the chemical industry will also show their products in the halls of other branches of industry so as to be in direct contact with the buyers and users of these products. In Hanover far more than 150 firms of the chemical industry, including some foreign chemical firms will be represented.

The German makers of basic chemical products do not expect to achieve extensive direct sales at the Hanover Fair. Primarily they consider it to be their task to give new suggestions to the experts and potential buyers coming from all over the world and to discuss problems of technical operation, methods, and applications of their products.

The organisation of the German chemical industry (Verband der Chemischen Industrie) and the study group of the plastics industry (Arbeitsgemeinschaft Kunststoff-Industrie) will set up special information bureaux to help in this task.

Apart from many well-known and generally approved products such as Buna rubber, the Industries Fair will also offer a number of interesting new products such as special quality varnishes, corrosion-proof covers, new basic materials for cosmetics and pharmaceuticals, special qualities of sulphur, etc. Furthermore, there are new indanthrene dyestuffs as well as improvements in protective materials for wood with the use of specially developed mineral oils. Agriculture and forestry experts will be interested in new fertilisers, pest control products and disinfectants against virus illnesses in animals. For the textiles industry there are new compounds of colloidal aluminates soluble in water which can be used for water-proof impregnations, as well as other new developments in the field of accessory materials.

The German plastics industry will also show a number of newly developed products such as a new pressure die-casting material, which after setting retains its shape under changing temperatures—this can be used for the manufacture of artificial teeth or as a covering substance in the paper, leather or textiles industry. In addition to this, there is a new material called 'Harlon' which corresponds in some ways to the foreign product known as 'Saran'.

Accept Nomination

Six of the seven retiring members of the Council of the Pharmaceutical Society, among them Alderman W. John Tristram, Liverpool, vice-president, are among the fifteen members of the Society who have accepted nomination for the seven vacancies in the Council to be filled at the annual election in May. The seventh, Mrs. Jean Kennedy Irvine, M.B.E., first woman president of the Society, does not seek re-election.

Future Trends of Electrolytic Processes

SCI Holds Two-day Symposium

A WIDE range of aspects concerning the application of electrolytic methods to chemistry and metallurgy was discussed at a symposium, 'Electrolytic Processes in Chemical and Metallurgical Industry', organised by the Society of Chemical Industry, which was held at University College, London, on 7 and 8 April.

At the opening session on the first day an introductory address was given by Dr. H. J. T. Ellingham, F.R.I.C., M.I.Chem.E., F.I.M., on 'Principles of Electrolytic Processes'. The session was then devoted to papers and discussion on extraction from fused salts.

The first speaker, Dr. A. L. Hock (Magnesium Elektron, Ltd.) taking as his subject 'Electrolytic Extraction of Magnesium from Fused Salts', said that the main problem had been the technically satisfactory and economic large-scale production of anhydrous magnesium chloride.

Naturally occurring carnallite $KCl.MgCl_2.6H_2O$ formed the basis of early electrolytes because it could be dehydrated on the large scale in simple plant, but the technical difficulties and the losses of material associated with the use of anhydrous natural or 'synthetic' carnallite in the electrolysis gradually led to the abandonment of carnallite baths.

Fluoride bath electrolysis for magnesium had never been operated satisfactorily and was not likely to be tried again.

Present-Day Processes

Present-day processes for the extraction of magnesium from chloride baths relied on more or less anhydrous magnesium chloride containing small amounts of sodium, potassium, or calcium chlorides. The composition of the electrolyte and whether or not it was added to the cell in completely anhydrous form depended on the nature and composition of the raw materials and on economic circumstances which varied with the location of the plant. A compromise was made between many factors so as to achieve the best economic result. The I.G.-M.E.L. process and the Dow Chemical Company process were illustrated as examples.

'Electrolytic Production and Refining of Aluminium' were next discussed by J. Waddington, M.Sc., A.I.M. (British Aluminium Co., Ltd.), who began his paper with a description of the Hall-Herault process for the production of aluminium by the electrolysis of a solution of purified alumina in molten cryolite at about 970°C.

Various Types of Cell

Various types of cell were described and illustrated. The pre-baked anode cells which were standard for many years were now being largely replaced by cells employing a self-baking Soderberg anode to which electrical contact might be made by stubs driven into the sides, or, more recently, by vertical stubs. The latest designs permitted the collection for later treatment of the electrolytic gases and fumes.

Virgin aluminium produced in such cells might be 99.5—99.8 per cent pure, the chief impurities being iron, silicon, and, to a less extent, titanium.

The aluminium might be refined by a second fused salt electrolytic process in the so-called 'three-layer' cell. The ordinary virgin, or alternatively scrap, aluminium was alloyed with copper to form a dense molten layer in the bottom of the cell. The intermediate electrolyte layer consisted of a mixture of molten fluorides and chlorides, having a density greater than that used in the reduction process and a lower melting point. The molten purified metal (99.99 per cent pure) floating on the surface of the electrolyte formed the anode.

Such a cell taking 16,000 amperes might operate at 6-8 volts and almost 100 per cent current efficiency. A further 10 kWh per lb. of aluminium was therefore required for the refining process to give super purity metal.

On the second day of the symposium there were two sessions. At the first, extraction and refining from aqueous solutions were discussed and two papers delivered.

'Recent Advances in the Electrolytic Extraction of Manganese, Chromium, and Cobalt,' were reviewed by Dr. J. W. Cuthbertson, F.I.M., A.M.I.E.E. (Tin Research Institute) who said that in recent years the growing demand for chromium, manganese

and cobalt had stimulated research on the recovery of these metals from low-grade ores of the type that could not profitably be treated by conventional smelting methods.

As a result of much intensive work, mainly by the United States Bureau of Mines, it had been demonstrated that ores which could be smelted economically might be amenable to electrolytic extraction, and substantial progress had been made in the handling of low-grade domestic ores by electrolytic methods. The electrolytic extraction of manganese in the U.S.A. was now an established industry and electrolytic extraction of chromium and cobalt had reached the pilot plant stage.

Progress Outlined

Progress made in the theory and practice of the electrodeposition of tin and its alloys during the last 15 years was next outlined by Dr. E. S. Hedges, A.R.I.C., F.I.M., and Dr. J. W. Cuthbertson. The theory and practice of the processes for the tin-copper alloy speculum, and the protective tin-zinc alloy devised mainly as a substitute for the cadmium were reviewed.

Latest work on tin-alloy plating related to the co-deposition of tin and nickel. The electrodeposited tin-nickel alloy coating possessed unique properties and was of particular metallurgical interest in that its structure differed from that of the corresponding cast alloy.

The final session was opened by B. S. Woods, B.Sc., F.R.I.C., A.M.I.Chem.E. (Laporte Chemicals, Ltd.) with a paper on 'The Manufacture of Hydrogen Peroxide'. The modern method was a cyclic process, comprising a double operation, electrolysis followed by distillation. The speaker, however, dealt mainly with the first stage.

Systems chiefly dealt with were those known as all-liquid processes, which were so designed that there was no separation of solid at any stage in the cycle, and were based on either an aqueous solution of sulphuric acid or a mixed solution of ammonium sulphate and sulphuric acid. Various factors affecting the electrolysis operation were included.

A number of explanations which had been put forward to account for the anodic reactions were summarised, together with some of the secondary reactions which affected the electrolytic efficiency and the hydrolysis reaction. An outline was given of the two general designs of cell, the first based on the flow of anolyte liquor only, with static catholyte, known as single chamber cells, and the other based on a double chamber principle, which employed a liquor flow through both anolyte and catholyte compartments.

Essential features of the described cell construction were platinum anodes and either lead or graphite cathodes separated by a diaphragm, all being contained in stoneware baths.

To wind up the symposium, an historical review of the development of the production of elemental fluorine from the early work of Moissan to the present day industrial process was given by R. J. Kingdom (Imperial Smelting Corporation).

Basic principles of fluorine generation had not changed in any way over the years. The early workers, recognising the high reactivity of fluorine and perhaps over-estimating it, built their cells of costly materials such as platinum, iridium, silver, and so on. The tendency had been to use simpler and cheaper materials ranging through nickel, monel metal, copper and finally mild steel.

The main obstacle to the industrial development of fluorine generation was removed when anhydrous hydrofluoric acid became available. Anhydrous hydrofluoric acid was absolutely necessary, since it was the only ionising solvent which would not react with fluorine gas.

Fluorine was produced by the electrolysis of potassium fluoride in a solution of anhydrous hydrofluoric acid. Since this acid had a boiling point of 19.7°C., it was necessary to select a ratio of HF and potassium fluoride which gave the lowest vapour pressure.

A Major Problem

One of the major problems of design was presented by the electrodes in a fluorine cell, particularly the anodes, where the fluorine was produced. Atomic fluorine readily attacked all metals. Where the fluorine film was tenacious, corrosion took place slowly, and where it was loose, corrosion was rapid.

Nickel had been used as an anode material with some success. Recently carbon anodes had been used successfully. Initially the carbon anodes were run at current densities of 200-300 amps. per sq. ft., but more recently standard electrode carbon run at no more than 70 amps. per sq. ft. had given good service.

Solvents & Plasticisers

Howard & Sons in the Field of Catalytic Hydrogenation

CATALYTIC hydrogenation is providing Britain with an impressive range of solvents, plasticisers and technical chemicals, which are finding an ever-widening field of application. As ingredients of paints, varnishes, plastics, rubber chemicals and many other essential commodities, these materials are of importance to almost every section of industry.

Prominently identified with the development of this rapidly expanding branch of chemical manufacture is Howards & Sons, Ltd., of Ilford. This enterprising firm has a history which goes back to 1797, but until the end of the first world war its activities were confined almost entirely to the pharmaceutical field and nearly all its products were inorganic. The establishment of a hydrogenation plant was the result of a decision taken after the First World War to set up a separate department devoted solely to research. In charge of this new department was John William Blagden, Ph.D., M.Sc., F.I.C., who had worked for many years in the research department of C. F. Boehringer & Sohne, Mannheim, and had been interned during the war. Howards & Sons had long been among the world's foremost quinine manufacturers and several of its directors were renowned quinologists. It was natural, therefore, that Blagden should start working on the preparation of derivatives of cinchona alkaloids.

Catalytic Hydrogenation

In the course of this research, he evolved a technique for catalytic hydrogenation which gave an entirely new orientation to the development programme, since it proved to be readily adaptable to the production on a commercial scale of a wide range of other materials. The first chemical manufactured on a large scale by the new technique was *iso*propyl alcohol, which was introduced to the market in 1921 under the brand name 'Avantine'. It was the forerunner of an important series of hydrogenation products, most of which had never previously been manufactured in Britain.

Among the most useful chemicals derived from this process are the hydrogenated phenols and cresols, cyclohexanol and sextol. These chemicals have many industrial uses of their own and are also valuable intermediates in the manufacture of other products.

Cyclohexanol is produced by a standard type of hydrogenation process, using a nickel catalyst. It is the starting material for cyclohexanol phthalate, cylohexanol stearate, cyclohexanone and cyclohexylamine, all of which have wide fields of industrial applications. The sharp melting point of cyclohexanol phthalate determines its particular uses, its most important application being as a plasticiser for nitro-cellulose.

Many Applications

The stearate is use as a plasticiser and in the retexturing of garments. Cyclohexanone finds its principal applications as a solvent for P.V.C. and nitro-cellulose, and as an intermediate in the production of hormones, etc. It is from the ketone group that the high solvent properties of this chemical are obtained. Cyclohexylamine is used mainly as a textile dyeing assistant, as an intermediate in the production of rubber chemicals of various types, and as a general intermediate in chemical synthesis. In this case it is the reactive amine group which plays such an important part in determining the field of usage.

Starting with cresol, hydrogenation yields sextol (methyl cyclohexanol), from which are derived sextol phthalate, sextol stearate, sextone B, and Resin MS2. Sextol itself is widely used in the paint industry as a high-boiling solvent for promoting flow and gloss in stoving type finishes. It is also a valuable solvent for soaps and synthetic detergents, being used to increase their detergent, emulsifying and cleaning properties, particularly in the textile, laundry and dry-cleaning industries.

Sextol phthalate is a plasticiser for nitrocellulose, P.V.C., shellac and urea-formaldehyde type resins, etc. Having a particularly low vapour pressure it is a permanent plasticiser. The stearate is used as a textile lubricant, a mould lubricant in plastic moulding, and as a plasticiser for leather finishes, the properties imparted by this chemical in the

latter instance being water-resistance and easy glazing. Sextone B (methyl cyclohexanone) is a general all-round solvent for nitrocellulose, P.V.C., and resins of all types.

Resin MS2 is a cyclic ketone resin which has particular value as a means of imparting gloss and water-resistance to oil paints, varnishes and cellulose lacquers. It has the advantage of being soluble in white spirit and can therefore be run cold in an oil varnish. Being a neutral resin and also water-resistant, it is particularly useful in the production of luminous and metallic paints.

The company also laid down the first plant in Britain for the manufacture of lauryl alcohol, another chemical obtained by catalytic hydrogenation, which is also being produced on a considerable scale. Sulphated lauryl alcohol is the basis of detergents employed in the laundry, textile and cosmetic industries. In this form it is one of the best synthetic detergents known. Lauryl alcohol is also the starting point for a number of very interesting esters, which find applications in all fields of surface coating. It is now in very widespread use and production is being expanded to meet the demand.

Catalytic hydrogenation processes require large quantities of hydrogen of the highest possible purity, which is produced by the electrolysis of water. The company generates most of the electric power needed for the production of its hydrogen requirements. In 1932, a new self-contained power house was constructed, which supplies electric power and steam for normal factory use as well as electric power for the hydrogenation plant. The steady growth in the output of hydrogenation products has resulted in a corresponding increase in the demand for power. The power house was extended in 1939, and its capacity has been nearly doubled by a further addition which was completed in 1948.

Forty New Lines Added

Since the inauguration of the Research Department some forty new lines of considerable importance to industry or medicine have been added to the Howards range. Research is continually proceeding with a view to the development of new or improved solvents and plasticisers, and production is being expanded as rapidly as circumstances permit. The proportion of these chemicals which can be exported is limited by the home demand for essential purposes, but as ingredients of scores of commodities these products are making a major contribution to the export drive.

The progress of this relatively new branch of a business established more than 150 years ago has been paralleled by advances in the development and production of drugs and fine chemicals, a field in which the company has always played a leading role.

New U.S. Polyethylene Unit

CONSTRUCTION of a major unit for the production of polyethylene resins has just been announced as an addition to the Texas City plant of the U.S. Carbide and Carbon Chemicals Company, a division of Union Carbide and Carbon Corporation. Construction will begin immediately, and the unit is expected to be in production by early 1953.

The production process will involve the direct polymerisation of ethylene at high pressure. Estimated production of this unit is 22,000 tons a year, and it has been estimated that the total U.S. annual production of polyethylene from all producers, will be between twice and three times this amount by the end of 1952. By this time the military requirements for applications of extreme urgency will still be in excess of the country's ability to produce polyethylene. These requirements will continue to increase during 1953 if the rearmament programme continues at its present rate, and so all the output of the Texas City unit will go for defence.

Military applications for polyethylene include light-weght, efficient insulation for infantry 'assault' wire or field telephone wire, high-frequency cable for air-borne and ship radar systems, and harbour defence cable for anti-submarine work. Insulation for fire, police, telephone, and air alarm cables are important civilian defence uses for it and it is also needed for the packaging of many military materials.

Because of increasing military requirements, the National Production Authority ordered the placing of polyethylene on an allocation basis as a scarce chemical from 1 June, 1951.

The actual new construction planned at Texas City includes three new buildings on an 8-acre plot.

British Iron & Steel Research Association

Annual Report for 1951 Issued

THE need for conserving scarce materials and for making the best possible use of available resources is emphasised in the British Iron and Steel Research Association's Annual Report for 1951, which has just been issued.

According to the Report, by the end of the year many of the projects directed to these ends had reached the development and application stages, as might be expected from the fact that this was BISRA's sixth year of existence. Included among them was an investigation into the methods by which a steel surface was descaled and cleaned. Special attention was given to sulphuric acid pickling, by both batch and continuous processes, and in view of the shortage of sulphur, to problems of economy in the use of acid and its recovery from waste liquor.

At the time the Report was being prepared, the pilot plant for the production of sulphuric acid from ferrous sulphate by the autoxidation process was expected to be working shortly at the Old Castle Works of the Steel Company of Wales. Close collaboration had been maintained with Simon-Carves, who were manufacturing the plant, during all stages of its design.

Ozone Used

The problem of finding materials of construction for the pilot plant which would not poison the catalyst used in the autoxidation process had been greatly simplified by the discovery that ozone killed many of the catalyst poisons. This meant that certain materials could now be used which were comparatively cheap but could not previously be considered because of their harmful effect on the catalyst.

Desulphurisation of iron by means of lime was investigated in the laboratory during the year in the hope of developing a similar full-scale method, external to the blast furnace. Fairly rapid desulphurisation was possible when only the surface layers of the lime lumps were concerned in the reaction, and lime fired to 1200° C. was more efficient than that fired at 1400° C. From the experiments it had been possible to obtain an estimate of the lime surface needed to achieve a given degree of desulphurisation.

Since the most effective desulphurisation was produced by the surface layers, a logical development of this work was to coat the lime on to lumps of coke: this procedure economised in both lime and coke, since the coke lumps might be washed and re-coated for further use. It would permit the collection of a slurry for the subsequent recovery of sulphur if necessary.

Work on these lines was continuing and pilot-scale trials of both lime lumps and lime-coated coke would shortly be made at the BISRA Sheffield Laboratories.

The Chemistry Department's Work

Work of the chemistry department continued to be devoted to fundamental physico-chemical studies of interest to iron- and steel-making processes. The acquisition of additional accommodation at Battersea had made it possible for the physical chemistry, refractories and corrosion sections to be housed under one roof.

Experimental work at Battersea covered a wide range. The heats of formation of Na_2O, CaO, MnO, P_2O_5, SiO_2, MnS, Mn_2SiO_4, $Ca_3P_2O_8$ and $Ca_4P_2O_9$ had been determined and the free energies of formation calculated. The work was being continued and it was expected that equipment for measuring high temperature heat contents would soon be in operation.

Other studies included the thermo-dynamics of phosphorus in liquid iron and sulphur in solid iron; and the movement of sulphur between gases and liquid iron via a steelmaking slag.

At Imperial College experimental work included the interaction of carbon and sulphur in liquid iron; investigation of the constitution of molten slags; and the thermodynamics of oxygen in solid iron and chromium and silicon in liquid iron.

A grant in aid from the association was given to Professor R. Hay and his team to assist their work at the Royal Technical College, Glasgow. A new apparatus for the rapid determination of the viscosity of slags using a photographic technique had proved very successful and was being used to study slag samples taken during the open hearth test at the Lanarkshire Steel Company, Ltd.

Collaborative work with the British Ceramic Research Association and with the steel and refractory manufacturers through the Joint Refractories Committee had been continued by the Refractories Section. Work had been begun on some laboratory projects at Battersea.

Various types of refractory ware had been made for a number of applications. A paper on super-refractory materials including carbides, nitrides, borides, and sulphides was in the hands of the British Ceramic Society for publication in its jubilee issue.

Much useful work which showed the value of its function as a link between fundamental concepts of science and the practical problems of the steel industry had been carried out in the Physics Department.

Instruments Section

In the instruments section an electric micromanometer had been developed for pilot tube measurements. It employed a mica diaphragm 0.001 in. thick which was metallised and acted as the moving plate of an electrical condenser. The device was sensitive to 0.0001 in. water gauge and had the advantage that application of a differential pressure produced a very small volume change.

Construction of a quick-acting balance for chemical assay work was well advanced. It employed an electrical force balance system which, with light construction of all moving parts, was expected to reduce the period to about 0.25 seconds. A sensitivity of 1 mg. with a capacity of 10 g. was aimed at. A crossed spring hinge was used for the main pivot which would have the advantage of a much longer life than agate knife edges.

The photoelectric dust meter had been suitably modified and installed on a blast furnace gas main to indicate the dust content in the gas. Three months' trial had shown it to be very useful for this purpose.

Tests of the strip width meter in a mill at Stewarts and Lloyds Ltd. had shown that a more rigid construction of the equipment was necessary and that the air jet cleaning of the glass windows was insufficient. An improved window mounting and air cleaning system had been designed and checked aerodynamically.

A theoretical study had been made of the desirable characteristics of coloured glasses used in melters' goggles and Chance Brothers were developing a 'Calorex' glass with cobalt blue colouring which would largely retain the useful characteristic of cobalt blue glass but would give better protection against infra-red rays. The colour would also be more easily reproduced.

Many of the recommendations of the Methods of Analysis Committee, Metallurgy (General) Division, were gaining international favour.

An extension of the draft sampling scheme for iron and steel to cover ferro-alloys had been submitted to the British Standards Institution for approval. Several reports were now awaiting publication, including papers on the absorptiometric determination of small amounts of chromium in iron and steel, the determination of molybdenum in low alloy steels and the determination of vanadium in ferro-vanadium; a comprehensive report on spectrographic analytical procedure had just been completed.

Among items engaging the attention of the committee towards the end of 1951 was the determination of boron, which is gaining importance because of its possible use in conserving certain scarce alloying elements. Other investigations were the determination of nickel in alloy steels, particularly in cobalt and copper-bearing steels, and the spectrographic determination of residual elements, which is important because of the increasing use of the spectrograph for iron and steel works analytical control.

Corrosion Laboratory

The Report states that the Corrosion Laboratory has been moved from Birmingham to Battersea, where temporary accommodation is being provided until permanent quarters, which are expected to be ready some time this year, become available. Some new researches were envisaged, but these could not be undertaken until the staff was increased.

In the Steel Division, the Gases and Non-Metallics Sub-committee had completed its vacuum fusion determination of the oxygen content of four steels.

This had shown that they were suitable as oxygen standards for the vacuum fusion method. The steels varied in oxygen content from 0.0145 to 0.003 per cent and were of the following types: basic bessemer rimming, basic bessemer heavily aluminium-treated, basic electric fully-killed, and basic open hearth fully-killed.

The Chemist's Bookshelf

THE CHEMISTRY OF SYNTHETIC DYES. By K. Venkataraman. Vol. I. Academic Press Inc., New York, 1952. Pp. xvi + 704. $14.50.

The author has set himself a very ambitious task to prepare, 'An up-to-date comprehensive survey of the entire field' of the chemistry of synthetic dyes, and judging by this volume (Vol. I) his efforts have been successful.

The book develops the subject systematically; thus Chapter 1 deals with the history of synthetic dyes and the organisation of the industry. The historical section makes interesting reading.

'Raw Materials', are dealt with in the second chapter which gives an account of the constituents of coal tar and their importance. However, aromatic hydrocarbons obtained from petroleum are discussed in two pages, while the remarks on the synthesis of primary materials are allotted even less, which is far too short to give a proper indication of the importance of these industries. Tests and standards of purity for the primary materials are mentioned in this chapter, in some cases in rather too great detail.

Chapter 3, 'Intermediates', 60 pages, gives a useful, concise summary of the preparation of the important intermediates, the value of this section being increased by the number of references given (570 patent and literature references).

In the next chapter, 'Diazotisation and Diazonium Salts' is justifiably discussed separated from intermediates, but 'stabilised diazo compounds for printing compositions' should be in the section on azoics, being a development of these dyes.

Using the chemical structure as a basis, dyes are classified in Chapter 5. It might be said that no completely satisfactory classification of dyes is possible.

Chapter 6, 'Application of Dyes', mentions machinery, textile fibres and non-textile uses of dyes. Although the references given for textile fibres are authoritative, the subject matter of this section is so condensed that it might have been preferable to leave it out completely.

Colour and its measurement, specification of colour and the human eye and colour vision are dealt with in Chapter 7, which can also be criticised on the grounds that these important subjects are too briefly discussed.

In Chapter 8, the author discusses colour and chemical constitution. This is a well referenced survey of a subject, the literature of which is extensive, and the author is to be thanked for this review. Minor criticisms of this chapter might be: (1) the definition of the hydrogen bond implies a chemical linkage rather than the much weaker electrostatic attraction generally accepted; and (2) the text explaining some of the tables falls on the following page to the tables.

The section on 'Azo dyes' (pages 409-704) is extensive and detailed and this is justified by the technical importance of this group of dyestuffs. The section is divided into chapters, each of which covers a particular azo structure, either from the point of view of components, or dyeing class. Separate chapters are given, for example, to stilbene dyes (included here are the stilbene derivatives not containing the azo group which are used as fluorescent bleaching agents), pyrazolones, and thiazoles. Next, azo dyes for cellulose acetate rayon are discussed, and the insoluble azo dyes, or 'azoics'. Mordant azo dyes have one chapter and the constitution of metal dye complexes is surveyed separately. The chapter dealing with mordant dyes is divided into sections, one section dealing with the azo salicylic acid dyes, and dyes derived from diazotised *o*-amino phenols, giving the *o,o'*-dihydroxy azo and similar types, are review in another section. Soluble chromium complexes of mono-azo dyes and copper complexes used as direct cotton dyes, the metallised dyes, are also discussed.

Direct cotton dyes, suitable for after-coppering are considered in Chapter 17 under

the section on after-treatments. The whole of this section shows the use the author has made of the BIOS, FIAT and other reports of the German dye industry. The introductory chapter on azo dyes, general, discusses the coupling reaction in detail, the constitution, colour and classification. The section on colour is particularly interesting, showing the influence of substituents and their position on colour, while the effect of sulphonic acid groups is also considered. Other chapters cover monoazo, bisazo, triazo and polyazo dyes.

There are short accounts of the nitroso and nitro dyes, the former being considered from the point of view of their metal complexing properties, and examples of the available dyes are given.

Well-known dyes of the nitro group are mentioned, also the use of the nitro diphenylamines for the dyeing of cellulose acetate rayon in the early days of the development of this fibre.

In spite of the criticism indicated, this book is the first volume of a publication which brings together a considerable mass of technically important information. This information is widespread, in some cases difficult to obtain and has demanded considerable reading of scientific papers and interpretation of patent literature. The references are authoritative and ample.

While the standard of binding, printing and paper expected of the Academic Press is maintained, and although the price is not excessive with regard to the volume of information contained, it is to be regretted that the cost may well put it out of reach of many British readers.—G. E. STYAN.

Midlands Analytical Society

THE last meeting of the 1951-52 Session of the Midlands Society for Analytical Chemistry will be held on Tuesday, 22 April, in the Mason Theatre of the University, Edmund Street, Birmingham, when the subject under discussion will be: 'The Analytical Chemistry of the Alkaline Earths'.

Two of the Society's members from the Nelson Research Laboratories of the English Electric Co., Stafford, have kindly offered to open the discussion. Mr. H. Thomas, B.Sc., A.R.I.C., will speak on 'The Analytical Chemistry of Calcium, Barium and Strontium', and Mr. A. J. Carwardine on 'The Analytical Chemistry of Magnesium'.

including fluorine, in Brazil, while the Industrial Development Commission is reported to be studying a proposal by a Frankfurt company to install plant in Brazil to manufacture photographic chemicals.

Applications to import hypochloride of calcium for the treatment of water supplies, refined paraffin and bicarbonate of soda, the latter for payment in inconvertible currencies only, are invited by the Export-Import Department.

Importation of 20,000 tons of insecticide for use on cotton plantations is said to be required by the state of S. Paulo.

In spite of expanding local production imports of chemical and pharmaceutical products increased by 51 per cent during the first nine months of last year, to 512,747 tons, valued at £36,807,200. Imports of barilla increased by 43 per cent; caustic soda, by 57 per cent; other inorganic chemical products by 50 per cent; and organic chemical products by 45 per cent.

Chemical products accounted for 3.6 per cent of the total imports from Britain in 1951, as compared with 1.6 per cent in 1948. In January and February of this year the Bank of Brazil issued licences to import British chemical and pharmaceutical products valued at £360,965.

Analysis of the trade returns during the past four years shows that of Brazil's total imports of chemical and pharmaceutical products 54.1 per cent came from the U.S.A., 17.5 per cent from Great Britain and 5.3 per cent from France and Italy together. In 1951 Germany re-entered the market and the Trade Agreement, signed with Brazil in December, indicates that there is likely to be keen competition.

Brazilian Chemicals

Britain's Share in Rising Imports

IN spite of the difficulty in obtaining raw materials from abroad in the latter half of the year, Brazil's chemical industry continued to expand during 1951.

A new caustic soda factory of 'Industrias Reunidas Matarazzo' began operating in S. Paulo and will be able to supply 10 per cent of Brazil's requirements. In February permits were issued to import from Britain 504½ tons of caustic soda, valued at £35,517.

The Vice President of the Pennsalt International Corporation has visited Rio and S. Paulo, with the object of arranging for the manufacture of the company's products.

HOME

Standards for Solvents

Two further standards in the series for solvents and allied products, not included in the original series, have now been issued by the British Standards Institution. These are B.S.1834: 1952 for *iso*propyl acetate and B.S.1835:1952 for 2-ethylhexyl alcohol (2-ethylhexanol), details of which were given in THE CHEMICAL AGE, **66**, 486. Copies (2s. each, post paid), may be obtained from the British Standards Institution.

High Polymer Fractionation Discussion

An opportunity of hearing an international authority on the physical chemistry of high polymers will be afforded the Plastics and Polymer Group (SCI) on 9 May, following its 29th annual general meeting at Whitehall Court, London, S.W.1, when Dr. R. F. Boyer (Dow Chemical Co., U.S.A.) will give a paper entitled 'A New Molecular Weight Distribution Technique', and will discuss some new developments of his method of fractionating high polymers, particularly polystyrene.

Alberta's Oil Industry

The Neil Matheson McWharrie Lecture 'The Oil Industry in Alberta' by Dr. S. M. Blair, will be presented before the Commonwealth Section of the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, on Thursday, 24 April, at 5.15 p.m. Mr. R. A. McMullen, Agent-General for Alberta, will preside. Tea can be obtained for 1s. from 4.30. Applications for tickets of admission should be addressed to the Secretary of the Society.

Change of Address

The Association of Chemical and Allied Employers announce that since Tuesday, 15 April, their address has been 166 Piccadilly, London, W.1. The provisional telephone number is MAYfair 2201.

Glassmakers Acquired

David Bennie and Sons, Ltd., steel rollers, of Petershill Road, Glasgow, have acquired the old established glass-making and laboratory glass firm of John Moncrieff, Ltd., St. Catherine's Road, Perth. The firm will be continued as previously, manufacturing the same range of products.

Increase in Copper Prices

The Minister of Supply has made an order adjusting the price of copper and copper alloy secondary and scrap metals, following the announcement by the Ministry of Materials of a £4 per ton increase in their virgin copper selling price. The Order—The Copper Zinc, etc., Prices Order 1952, S.I.1952 No.729—increases the maximum controlled prices of secondary unwrought copper by £4 per ton, copper scrap, gilding metal, and gun metal by £3 per ton, and cupro-nickel and brass by £2 per ton.

River Pollution Decision

Injunctions to prevent the pollution of the rivers Derwent and Trent, to be suspended for two years, were granted by Mr. Justice Harman in the Chancery Division on 7 April to the Pride of Derby and Derbyshire Angling Association and Lord Harrington against British Celanese, Ltd., Derby Corporation, and the British Electricity Authority. Costs were awarded to the plaintiffs. The defendants, said the judge, would be placed under an undertaking to indemnify the plaintiffs for any continuing damage arising from suspension of the injunctions. A great deal would have to be done during the two years' suspension and the courts would not tolerate any passive attitude by the defendants.

Obituary

We regret to announce that LADY MCGOWAN, wife of Lord McGowan, honorary president of Imperial Chemical Industries, Ltd., died in London on 8 April.

Lady McGowan had been her husband's constant companion on his world-wide travels during the past 40 years, and she sailed with her husband to South Africa on 17 January but became ill soon after their arrival in Cape Town. On medical advice it was decided that she should return home. Unfortunately, her condition worsened soon after her return. Lord McGowan came back by air from Madeira and reached her bedside before she died.

OVERSEAS

Queenstown Copper Expansion

Large-scale expansion of copper-mining at Queenstown, on the west coast of Tasmania, is planned by the Mount Lyell Company. More heavy equipment and rolling stock will be used and some of the big tracts of land south-west of Queenstown will be opened up for prospecting. The new equipment is to include three British electric shovels which have a capacity of 20 tons each, the biggest in the world. This development will mean a large increase in copper production from the mines, as well as in the output of sulphur as a by-product.

Yugoslavian Aluminium

A sum of 390,000,000 dinars has been allocated to the building of a new aluminium plant at Razina, near Sibenik, Dalmatia, according to Press reports. Capacity when the mill is finished will amount to 16,000 metric tons of rolled aluminium products yearly. The Razina mill is one of the largest investment projects planned for this year in Yugoslavia.

Demand for Krilium

The Monsanto Chemical Company of America reports that already it has been swamped with orders for Krilium, the synthetic soil conditioner announced by them recently, from all over the world. A company spokesman said that they would not be able to fill all the demands in five years. The orders came from all the American states and 40 foreign countries. The company hope to be able to sell Krilium eventually for as little as 25 cents a pound (1s. 9½d.), but it will not be on the market in quantity until 1953. Present production is still going into research products.

Fewer Chemical Accidents in U.S.A.

Continuing high standards of safety in the U.S. chemical industry were disclosed in the report of the Manufacturing Chemists' Association Inc., published on 10 April. For the first two months of this year, the frequency rate of accidents among member companies of the association was 3.86 per million man-hours of exposure. For 1951 with a total of 654,800,000 hours of exposure the accident frequency rate was 4.83. Both figures were an improvement over previous years.

Methane Gas Fire Extinguished

The fire which had been burning for 22 days in the methane gas wells near Milan, was extinguished on 14 April under the direction of Mr. Myron Kinley, who had flown out to Italy from Oklahoma.

Uranium in Israel

Reports of the finding of uranium deposits in the area were said to be receiving the attention of the Israeli Premier, Mr. David Ben Gurion, when he was on holiday in Tiberias on 11 April. The possibility of deposits of uranium and other radioactive substances near Millenia, south of the Sea of Galilee, has been suggested for some time, and expeditions of scientists from the Weizmann Institute and a Haifa institution have recently been sent there as well as to the Jordan Valley.

Canadian Sulphur Plant

Sulphur Converting Corp., a company backed by European and Canadian capital, plans to build a $5,000,000 sulphur plant at Roberval, Quebec, some 200 miles northeast of Quebec City. The project is said to be well advanced, land has been purchased, and plans have been made for mining in the Chibougamau region of pyrites, from which sulphur will be produced by a special process. The company, headed by J. A. Leclerc, of Montreal, hopes to be able to start construction of the plant in May and reach the production stage in 1953.

Another U.S. Atom Plant

A project to build a fifth atomic explosives plant at a cost of approximately $1,000,000,000 (£357,000,000) was announced in Washington on 11 April by the U.S. Atomic Energy Commission.

Dent-proof Car Body

A polyester plastic laminated with glass fibre, which is said to possess the ability to spring back into shape when dented by a blow, has been produced in America under the joint efforts of the Glasspar Company of California and the Naugatuck Chemical Division of the U.S. Rubber Company. These companies say that the body is rust-proof and dent-proof, and, for its weight, stronger than steel. The material is also said to hold paint well and not to oxidise.

OCCA Exhibition

continued from page 568]

respectively to stainless steel, aluminium and copper, the operations gave very good results. Also shown were illustrations of oil processing plant and varnish-making installations.

One panel of the stand of Shell Chemicals, Ltd., deal with applications of the company's range of 'Epikote' resins, which was introduced in a general way at last year's exhibition. Particular reference was made to their uses as primers for steel, aluminium and light alloys, and finishes resistant to a wide range of chemical reagents. Their standard range of solvents and other chemical products featured 'Alphanol 79' and 'Nonanol', two fairly new primary alcohols.

Laboratory Apparatus on Show

W. & J. George & Becker, Ltd., exhibited a range of laboratory apparatus including Nivoc balances of latest design, pieces of oil and petroleum testing equipment such as a penetrometer with an automatic time switch ensuring extreme accuracy to the five-second period. Cray Valley Products indulged in a larger-than-life-size cartoon by Ronald Searle depicting the various functions of a resin manufacturer's technical service laboratory; not, it is to be hoped, a typical account of what goes on in the laboratory of Cray Valley Products. Also shown, although rather dwarfed by the cartoon, were finishes based on two recently formulated alkyd resins, and the tests these have to pass through before marketing.

Styrene Co-polymers, Ltd., by a simple design and effective lighting, contributed one of the most pleasant-to-look-at stands of the exhibition. Illustrated were the moisture-resistance and washability of the recent emulsion paint finishes, in which styrene oil co-polymers are incorporated. Finally, National Titanium Pigments, Ltd., showed the background to the production of a high-quality pigment from its inception, the design and construction of a modern factory, to the technical control of the process and final product quality, and exhibits included equipment used to this end. A working demonstration was given of a new type of X-ray set developed and built by the company for the evaluation of the different allotropes of titanium dioxide (*see* THE CHEMICAL AGE, 64, 751).

New Industrial University

Hungarian Institution Nears Completion

COMPLETION of the third building of Veszprém Technical University was announced recently in the Hungarian Press. Already 520 students are in residence at the university, which is now the main centre for training and research in the heavy chemical industry. It contains four faculties—industrial chemistry, mineral oil and coal, electrochemistry and silicate industry.

The students study general chemistry for the first two years, and begin specialisation in the third year of their four-year course. The university contains a small coking plant, a pitch distilling plant and an oil refinery.

A five-storey laboratory building will be completed in the autumn. The main building, containing lecture rooms, a large congress hall and the university library, will be ready next year.

In the autumn the building housing the Heavy Chemical Industry Research Institute will be ready for occupation. The institute, which is housed temporarily in a wing of the university, is engaged on research into coke processes, the extraction of phenol from water gas, and on the production of low price artificial fertilisers.

The Research Institute for Hungarian Mineral Oil and Natural Gas, which is claimed to be one of the most up-to-date research institutes in Europe is also nearby.

It possesses a micro-balance, the foundations of which have been carried well below ground level to rock strata, and a Soviet-made spectroscope.

Its motor research station will be capable of testing motor fuel and lubricants under various conditions, including low temperatures.

No Concession on Light Oils

IN a statement dealing with the tax on light hydrocarbon oils used for industrial purposes issued by the Industrial Light Oils Committee the hope is expressed that the Chancellor of the Exchequer will reconsider his reasons for not granting a concession to industry of this onerous tax, and will at least grant a part remission of the tax.

It is pointed out that the Conservative Party voted against previous increases on the very grounds that the duty was an unfair burden on the manufacturing industry.

Publications & Announcements

'ANTRYCIDE'—its achievements and prospects are reviewed by W. T. Harrow (Imperial Chemical (Pharmaceuticals), Ltd.), in the April issue of the 'I.C.I. Magazine. In another article the question as to whether Britain has anything to learn from America in the selection and training of supervisors is discussed by F. H. Perkins (Education Officer), who was a member of the Anglo-American productivity team which visited the U.S.A. last year to compare the methods of the two countries.

* * *

A TENDENCY to stop and not pick up again if anything deflected the rotating magnet has been one of the problems of magnetic stirrers. This is claimed to have been overcome by an instrument with exceptionally powerful magnetic attraction devised by Townson & Mercer, Ltd., Croydon. The motor and its attached magnet are covered by a spun aluminium case and the motor magnet itself is an 'Alcomax' bar size 2 in. long by ¼ in. diameter. With this is supplied another 'Alcomax' magnet of the same size sealed into a glass tube. It is the use of these opposed magnets of great power which makes the stirrer self-starting.

* * *

PHYSICO-CHEMICAL properties of water-soluble ethyl-hydroxyethyl cellulose in solid state and in solution are investigated by Ingvar Jullander (research laboratory, Mo och Domsjö AB, Ornsköldsvik, Sweden) in an article (published in English) in *Svensk Papperstidning* (Swedish Paper Journal, Vol. 55, No. 6). Results are compared with information available in literature for similar types of cellulose ethers, of which the methyl and carboxymethyl celluloses are the most important. Two other articles, also in English, deal with the investigations of the Swedish Forest Products Research Laboratory, Wood Chemistry Department in examining the usefulness of *bis*-cyclohexanone-oxalyldihydrazone — (C_6H_{10}: N.NH.CO.CO.NH.N: C_6H_{10}) as a reagent for the quantitative determination of small amounts of copper in pulp and paper; and work of the Paper Technology Department on the micro-spectrographic determination of the distribution of the carboxyl groups in the cell walls of spruce, birch holocellulose and cotton, measured by light absorption.

TYPICAL applications of pure fused quartz and silica tubing and rod, supplied by The Thermal Syndicate, Ltd. under its trademark 'Vitreosil', are described and illustrated in a new brochure, now available, which gives the February, 1952, prices. 'Vitreosil' tubing and rod are produced in four qualities—sand surface, glazed, and satin surface, all translucent and transparent—identical in chemical characteristics and similar in most physical properties. The wide range of uses includes gas sampling tubes, electric furnace construction, pyrometer tubes and the quick-immersion thermocouple for taking the temperature of molten steel.

* * *

EYE accidents represent a large proportion of the industrial accidents which occur in the United Kingdom each year. Many of these casualties are caused by flying particles of metal or stone during such processes as grinding, chipping, fettling or similar operations and could often have been prevented by the provision of suitable spectacles or goggles fitted with safety lenses. British-made 'Armorglas' toughened lenses have recently been introduced by J. & R. Fleming, Ltd., of London. 'Armorglas' is prepared by specially heat-treating and cooling glass so that the resulting tensions produce a lens with a very tough surface which will withstand a heavy blow. Tests have, in fact, proved that it will stand up to several blows, and when it does break, it fractures into cubical pieces without sharp edges.

* * *

WHETHER this country will be satisfied with smoke abatement, burning raw coal with a minimum of smoke, or whether people will work for smoke abolition, which can only be achieved by using smokeless coals for domestic space heating, is discussed by Dr. G. E. Foxwell, president of the Institute of Fuel, in an article entitled 'Smokeless Fuel in Britain', in the spring number of *Smokeless Air* (Vol. 22, No. 81), journal of the National Smoke Abatement Society. A memorandum from the society to the Ridley committee on National Fuel Policy is also reproduced, one of its most interesting proposals being that for the prior approval of all new fuel-burning installations in industry.

FLOOR cleaning and treatment is the subject of a new illustrated leaflet just issued by Joseph Crosfield & Sons, Ltd., Warrington. Metsapol brand detergent, for which both hot and cold methods are described, is a detergent with excellent emulsifying and deflocculating properties. It contains sodium metasilicate with the addition of a wetting agent, and ensures quick and thorough penetration, which is important for the efficient cleaning of heavily soiled floors. Operatives are advised to wear rubber boots, protective gloves and apron when using Metsapol. A denser and harder surface which cuts down dusting is claimed from the treatment of new or old concrete floors by the company's Pyramid brand sodium silicate No. 1.

* * *

ADVANCE in vacuum technique is illustrated by the 25 mm. Camvac mercury vapour high-vacuum pump developed over the course of several years, but now commercially available for the first time. The pump is one of a number of interesting items and developments described and illustrated in the current issue of 'Towers Laboratory News' (No. 7), just issued by J. W. Towers & Co., Ltd., Widnes.

* * *

THE value of industrial research depends on the extent to which it is successfully applied, and the British Iron and Steel Association, founded in 1945, is doing much valuable work in helping to solve some of the industry's problems. The association's latest leaflet, now available, gives an informative survey of some of its research results which are ready or nearly ready to be used. Investigations reviewed include: the open hearth furnace; the best way of removing sulphur from iron; an automatic gauge control of cold-rolled strip which is now being developed and may well give Britain a lead in solving one of the most difficult problems that modern technology has posed; and the provision of reliable instruments for the inspection of wire drawing dies.

* * *

A PAMPHLET on gas-analysis published by Hartmann and Braun, AG, Frankfurt is now available from Kandem Electrical Ltd., 711 Fulham Road, London, S.W.6. This describes the company's range of instruments used in gas analysis operating on the principles of paramagnetic attraction (for oxygen), heat generation by gas absorption, change in the electrical conductivity of absorbing reagents, and so forth.

BOTTLES that bounce, is the claim made for its polythene containers, by Cascelloid, Ltd., Leicester, in an illustrated brochure now obtainable. Cascelloid polythene containers are suitable for a large range of chemicals, though there are some exceptions. The containers are light and easy to handle and save space in stores or warehouses where they can be stacked in layers. Closure is by a screw cap and gasket which fit tightly and easily and can be wired or sealed as a protection against tampering. Three sizes of containers are made—one, two and five gallons.

* * *

'OVERSEAS Survey, 1951', a 104-page publication issued for the first time by Barclays Bank (Dominion, Colonial and Overseas), deals with trade and economic and industrial conditions which prevailed during the year 1951 in various overseas territories. The richly illustrated book covers the mining output and many developments in industry, describing new factories which have been opened or are in the course of construction. Government aid has encouraged in many countries the establishment and development of new and the extension of existing industries, some of them connected with applied chemistry, and tables for foreign trade cover imports from and exports to the United Kingdom during 1951.

Next Week's Events

TUESDAY 22 APRIL

Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. E. C. Klepp: 'Recent Developments in Instruments'.

WEDNESDAY 23 APRIL

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6 p.m. Food Group—Nutrition Panel, annual general meeting; 6.15 p.m. Dr. V. L. S. Charley: 'Soft Drinks and Fruit Juices—with Comments on their Nutritional Value'.

Society of Public Analysts

Bristol: University, Woodland Road, 7 p.m. Microchemistry Group, joint meeting with the Bristol and District Sections of the Chemical Society, the RIC and the SCI. H. Swift and E. S. Morton: 'The Use of Cylinder Oxygen in the Organic Microdetermination of Nitrogen'; followed by a discussion on 'Standard Substances for Organic Micro-analysis'.

The Chemical Society

Manchester: University, 6.30 p.m. Hugo Müller Lecture. Professor F. A. Paneth: 'The Chemical Exploration of the Stratosphere'.

Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 4.30 p.m. Annual corporate meeting, 5.30 p.m. Dr. G. E. Foxwell (president), will present the Students' Medal and Prize for 1951 to Dr. G. F. Eveson, and will deliver his first presidential address: 'Fuel Technology and Civilisation'.

Manchester Literary & Philosophical Society

Manchester: Portico Library, Mosley Street, 5,45 p.m. Annual general meeting of the Chemical Section. Series of short papers by members.

Institute of Metal Finishing

Eastbourne: Grand Hotel (until 26 April). Annual general meeting, technical sessions and Spring conference.

THURSDAY 24 APRIL

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. F. Y. Henderson (director): 'The Forest Products Research Laboratory, Princes Risborough'.

The Chemical Society

Sheffield: University, 5.30 p.m., with Sheffield University Chemical Society. R. G. W. Norrish: 'Recent Developments in Photochemistry'.

FRIDAY 25 APRIL

Society of Chemical Industry

Margate: Winter Gardens, 9.30 a.m. Food Group joint meeting with the Royal Sanitary Institute. This meeting will constitute the Food and Nutrition Section of the Health Congress (22-25 April) arranged by the Royal Sanitary Institute. General subject of discussion will be 'Bacteriological Standards for Perishable Foods'. Proceedings will be opened by an address from Professor H. D. Kay, chairman of the Food Group, followed by four papers. W. Price-Davies (Ministry of Food, Scientific Adviser's Division): 'Recent Advances in the U.S.A.'; Dr. C. L. Heller (Ministry of Food, Scientific Adviser's Division): 'Manufactured Meats'; A. Rowlands (director, Astell Laboratory Service Co., Ltd): 'Milk and Dairy Products'; Dr. M. Ingram (Low Temperature Research Station, Cambridge): 'Egg Products'.

The Chemical Society

Swansea: University College, 5.30 p.m., with University College of Swansea Chemical Society. Professor E. R. H. Jones: 'Acetylenic Compounds'.

Institution of Chemical Engineers

London: Mayfair Hotel, Berkeley Street, W.1, 11 a.m. 30th Annual corporate meeting; 12 p.m. Sir Harold Hartley, presidential address: 'Chemical Engineering at the Cross Roads'; 7 p.m. annual dinner.

Institute of Physics

London: 47 Belgrave Square, S.W.1, 5.30 p.m. Industrial Spectroscopy Group: 'Impressions of Spectroscopy in the U.S.A.', etc.

Plastics Institute

Manchester: Engineers' Club, Albert Square, 6.45 p.m. B. T. A. Holland (TEC Products, Kodak, Ltd., Harrow); 'Cellulose Plastics' (with film).

SATURDAY 26 APRIL

Society of Public Analysts

Manchester: Engineers' Club, Albert Square, 2 p.m. North of England Section. R. Belcher: 'Some New Methods in Analytical Chemistry'.

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Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

MULA (CHEMICALS) LTD., Birmingham. (S., 19/4/52.) 12 March, mortgage, to District Bank Ltd. securing all moneys due or to become due to the Bank; charged on Allens Farm, Horley and Burstow (Sy.). *£4,983. 4 December 1951.

CHEMO-METALS (LONDON) LTD. (M., 12/4/52.) 5 March agreement endorsed upon a debenture dated 20 July 1951, securing £5,000 (not ex.), to Midland Bank Executor and Trustee Co. Ltd.; general charge. *Nil. 20 July 1949.

Satisfactions

BRITISH CELANESE LTD., London, W. (M.S., 19/4/52.) Satisfaction 15 March of debenture stock registered 2 October 1943 and 8 November 1944, to the extent of £25,368; also Satisfaction 15 March of debenture stock registered 24 September 1946, to the extent of £4,000.

EVANS MEDICAL SUPPLIES LTD. (formerly Evans Sons Lescher & Webb Ltd.), Liverpool. (M.S., 19/4/52.) Satisfaction 14 March, of debenture stock registered 12 March 1943 and 1 November 1951, to the extent of £12,000.

New Registrations

E. C. Rich (Chemicals), Ltd.

Private company. (506,265). Capital £500. To acquire the business of manufacturers' agents carried on at 113 Station Road, Wylde Green, Sutton Coldfield, as E. C. Rich & Sons. Directors: Ernest C. Rich and Mrs. Dorothy I. Rich. Reg. office: 113 Station Road, Wylde Green, Sutton Coldfield.

Edwards and Co. (Plastics), Ltd.

Private company. (506,554). Capital £1,000. Manufacturers, moulders and fabricators of all forms of urea-formaldehyde and by-products thereof. Directors: Leonard F. Edwards and Robert H. Davis. Solicitors: W. T. Jones. Registered office: 3 Eli Mews, Eli Street, W.14.

Ulter (Bradford), Ltd.

Private company. (506,534). Capital £1,000. Manufacturers, importers and exporters of, and agents for, and wholesale and retail dealers in chemicals for pharmaceutical, technical, electrical, photographic, scientific and other purposes, chemists' sundries, etc. First directors to be appointed by subscribers. Reg. office: 1 Delph Crescent, Clayton, Bradford.

Company News

Aluminium, Ltd.

A successful development story is recorded in the report for the year 1951 of Aluminium, Ltd., Montreal, Canada, submitted to the shareholders by the president, Mr. Nathaniel V. Davis. Sales have expanded from $12,000,000 in 1928 to $284,000,000 in 1951, including a 150 per cent expansion since peace operations were resumed in 1945. Net profit for 1951, after depreciation, income taxes and all other charges was $28,760,876, or the equivalent of $7.03 a share. Two major expansion programmes were being carried out. One in Quebec, it was estimated, would cost approximately $110,000,000 and was designed to increase production at an early date to about 500,000 metric tons a year. A longer-term project was being carried out in British Columbia to produce ultimately 500,000 metric tons of aluminium a year, the first phase costing about $195,000,000. Other expansion schemes included bauxite mining facilities in Jamaica and on the Los Islands French West Africa. Research was directed at process and product improvement in the smelting, fabrication and utilisation fields. The technical organisation had continued to investigate sources of additional raw material supplies and potential sites adapted to economic production of aluminium.

LABORATORY EQUIPMENT

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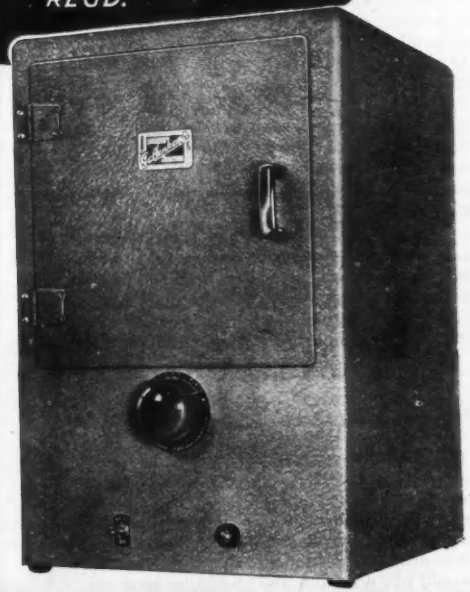

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Market Reports

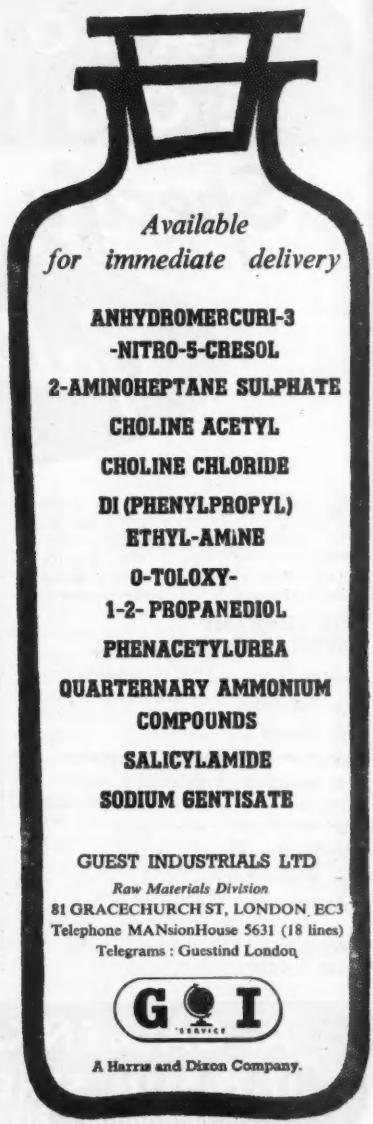
LONDON.—Conditions in the industrial chemicals market remain unchanged with the volume of home inquiry on a small scale, due partly to the shorter working week. A fair inquiry for shipment is reported and the general tone of the market continues steady with quotations firms at recent levels. There has been no special feature in the coal tar products market where deliveries against contracts form the greater part of the movement.

MANCHESTER.—Trading in heavy chemicals on the Manchester market during the past week has opened slowly after the Easter holiday break and so far as new bookings are concerned it is likely to be well into next week before conditions are something approaching normal again. Many Lancashire cotton mills are closed for the whole week in consequence of the sharp decline in the demand for textile goods, which continues to effect adversely the demand for the wide range of chemicals used in the bleaching, dyeing and finishing trades. In most other directions, however, contract deliveries have been resumed fairly well. Moderate activity has been reported in the market for fertilisers, with a fair trade passing in general run of tar products.

GLASGOW.—The uplift in trade experienced towards the end of last week has been maintained and there has been a steady demand for the majority of general chemicals throughout the week. The export position remains more or less unchanged.

Phosphorus as Fireproofer

TESTS of phosphorus compounds for possible use in the fire-proofing of textiles are being carried out at Columbia University. It was hoped to develop a fire-retarding substance which could be applied without diminishing the strength of the fabric, that would not wash out and would be economical. This was announced by Professor James Church in an address to the American Chemical Society in Buffalo, New York. Existing processes for fire-proofing fabrics were mostly too expensive as they added anything from 10 to 25 cents (about 9d. to 1s. 9d.) per yard to the cost of the cloth. —B.U.P.



Publishing Interest Aquired

ERNEST BENN, LTD., book publishing associates of Benn Brothers, Ltd., publishers of THE CHEMICAL AGE, have recently acquired a substantial interest in Quality Press, Ltd. Chairman of Quality Press is Mr. Keon Hughes, a director of Benn Brothers, Ltd., and managing director of Ernest Benn, Ltd.—positions he continues to hold.

Remaining as managing director of Quality Press is Mr. A. D. Marks, one of the most experienced members of the publishing profession, who is rejoining the organisation with which he started as an office boy sixty years ago. The other director of Quality Press will be Mr. A. R. C. Fleming.

Benn's book publishing reputation was founded in the 1920's on the famous Sixpenny Library. In more recent years the firm has published books by Winston Churchill, A. P. Herbert and older favourites such as Joseph Conrad, H. G. Wells and Ethel M. Dell.

KEEBUSH

Keebush is an acid-resisting constructional material used for the construction of tanks, pumps, pipes, valves, fans, etc. It is completely inert to most commercial acids; is unaffected by temperatures up to 130°C; possesses a relatively high mechanical strength, and is unaffected by thermal shock. It is being used in most industries where acids are also being used. Write for particulars to—

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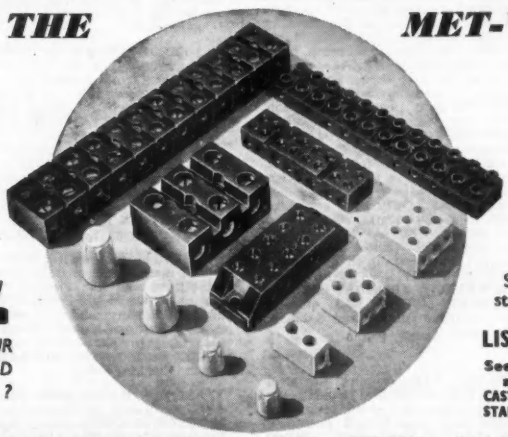

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CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

THE INSTITUTION OF CHEMICAL ENGINEERS' 28th ASSOCIATE MEMBERSHIP EXAMINATION

APPLICATION forms (returnable June 2nd, 1952) and particulars of the 28th Associate Membership Examination, may be obtained from Hon. Registrar, **INSTITUTION OF CHEMICAL ENGINEERS, 56, VICTORIA STREET, LONDON, S.W.1.**

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive, or a woman aged* 18-59 *inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1952, may eventually be announced. The scientific posts are in various Government Departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. The patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a University Degree with first or second-class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification, or for scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must, in addition, have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and patent posts taking their Degrees in 1952 may be admitted to compete before the result of their Degree examination is known.

Age Limits: Senior Scientific Officers, between 26 and 31; for Scientific Officers and Patent Classes, between 21 and 28 during 1952 (up to 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London Salary Scales: Senior Scientific Officers (men), £812-£1,022; (women), £681-£917; Scientific Officers (men), £440-£707; (women), £440-£576; Patent Examiner and Patent Officer Classes (men), £440-£655. (Rates for women under review.) Somewhat lower rates in the provinces.

Further particulars from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S. 53/52 for Senior Scientific Officers and S. 52/52, S. 128/52 for the other posts.
16045/120/WP

BOOTS PURE DRUG CO. LTD., require Chemical Engineers for positions in their Chemical Department. Candidates should have had experience in the design and construction of chemical plant and should possess a University Degree in Chemical Engineering. Salary according to qualifications and experience. Contributory pension scheme.

Applications to the **PERSONNEL MANAGER, STATION STREET, NOTTINGHAM**

SITUATIONS VACANT

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. A closing date for the receipt of applications earlier than December, 1952, may eventually be announced either for the competition as a whole or in one or more subjects.

The posts are divided between following main groups and subjects: (*a*) Mathematical and Physical Sciences; (*b*) Chemistry and Metallurgy; (*c*) Biological Sciences; (*d*) Engineering subjects; and (*e*) Miscellaneous (including, *e.g.*, Geology, Library and Technical Information Services).

AGE LIMITS: For Experimental Officers, at least 26, and under 31 on 31st December, 1952; for Assistant Experimental Officers at least 18 and under 28 on 31st December, 1952. Extension for regular service in H.M. Forces.

Candidates must have obtained, or be taking examinations during 1952 with a view to obtaining, the Higher School Certificate with mathematics or a science subject as a principal subject, or the General Certificate of Education in appropriate subjects, or the Higher National Certificate or other specified qualifications. Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. Candidates over 20 will generally be expected to have higher qualifications.

Inclusive London salary scales:—
Experimental Officer: £628-£786 (men); £533-£655 (women).
Assistant Experimental Officers: £275-£586 (men); £275-£489 (women).
Starting pay according to age up to 26: At 18, £275; at 26, £498 (men); £467 (women).
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Further particulars and application forms from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S94-95/52. Completed application forms should be returned as soon as possible.
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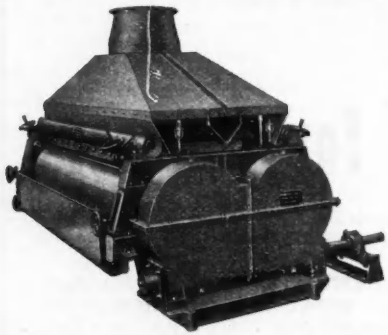

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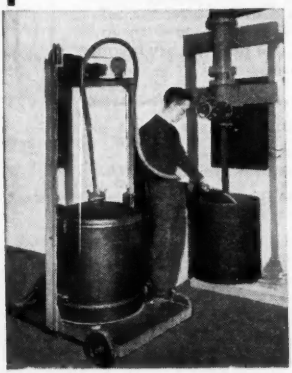

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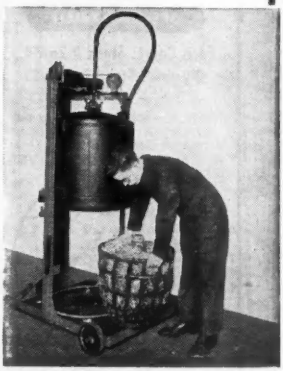

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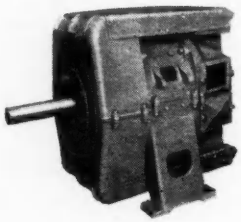

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